AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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The Stiles Punching Press.

The engraving on this page represents the latest and improved form of a well-known punching press, formerly built by the Stiles & Parker Press Company, and now built by the E. W. Bliss Company, of Brooklyn, N. Y.

Most of our readers, are, of course, familiar with the many uses to which these machines have been put in manufacturing, both here and abroad, their range of adaptation covering nearly all operations of blanking, cutting, punching, perforating, forming and bending sheet metal used in the manufacture of hardware, locks, cutlery, guns, sewing machines, typewriters, etc.

In the fly wheel, which is of improved pattern, there is a clutch pin which is released by pressing the treadle in front of the machine, and, by the action of a spring, is forced into a seat provided for it in the large flange on the crankshaft, being automatically disengaged at the completion of the stroke, unless the foot treadle be still depressed.

The crankshaft has been made much heavier than formerly, is of steel, and the pin runs in a gun metal bushing.

The pitman connection is of steel, its lower end fitting into a solid seat in the slide.

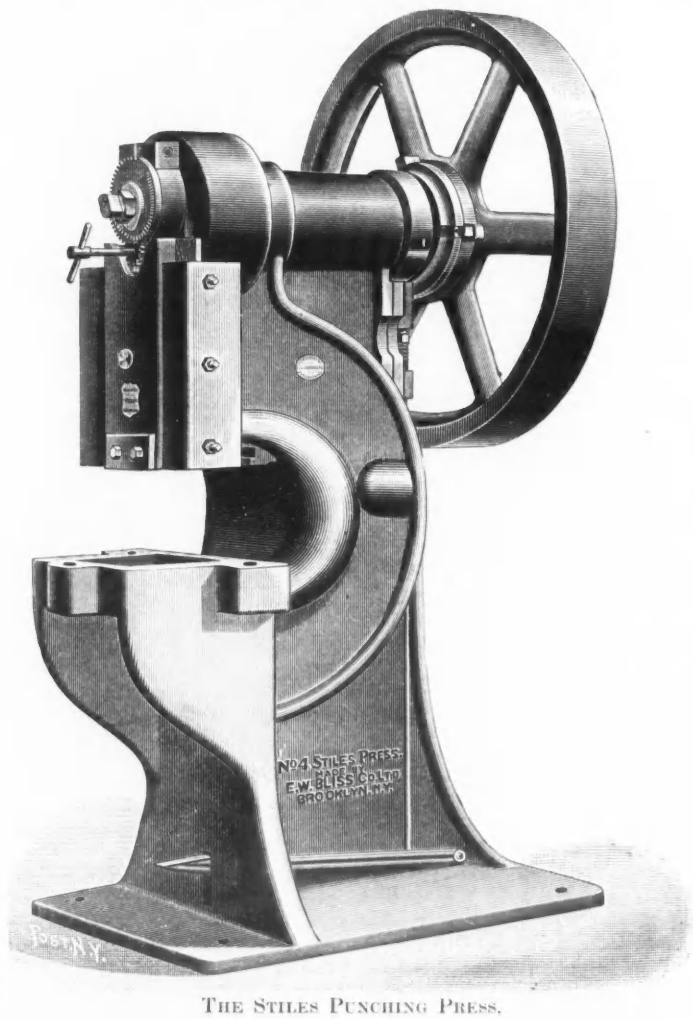
There is an eccentric in the slide by which vertical adjustment is effected, the eccentric being turned by means of a toothed pinion, and having upon its face graduations indicating the adjustment in hundredths of an inch.

The slide has been increased in length, and is accurately fitted by scraping, so that the most delicate punches and dies may be used, as in watch and clock making.

Where desired, a second eccentric is applied to the crank, by which the length of stroke may be varied at will. In some cases, also, three clutch pins are put in, so that the wheel never makes more than one-third of a revolution after depressing the treadle, before the pin engages.

A T slot is cast on the throat of the frame to which strippers, gauges or other devices may be fastened.

There is a positive stop, which, when desired, prevents a second stroke of the slide, even should the treadle not be released. The machines are made in nine sizes, to suit every class of work.



THE STILES PUNCHING PRESS.

Assembled Drawings.

BY W. D. FORBES, M. E.

Those who run machine shops are constantly being asked to give estimates on work from assembled drawings; in most cases the party wanting figures will allow ten minutes, or even a quarter of an hour, to get them up in. Such estimates are misnamed—"guesses" they should be called, and from them arise no end of trouble and misunderstanding.

From non-professional men this might be expected, but the writer could name men who stand very high in their specialties, who have handed to him assembled drawings only for estimates; and this is more astounding when it is remembered that they are not only educated engineers, but really practical men, who know that every bolt and pin, nut and washer costs something, and that every surface which is to be machined demands an outlay of money, that the position and form of finished surfaces determines in a large degree their cost. Yet with full knowledge of all this they furnish an assembled drawing which requires the maximum amount of time to understand, and which gives the minimum opportunity of obtaining the information on which to reckon costs.

Assembled drawings have their use, of course, and must be furnished for many reasons, but before any work can be properly begun, or any real estimate given, each part in detail should be made as clear as possible by a separate drawing, and it is safe to say at least ten per cent. can be saved and much trouble avoided by such drawings.

Each piece on a separate sheet of paper and *numbered* prevents no end of confusion, as we all understand and can read numbers, and therefore there is nothing to explain concerning them, and "Part 6" can be found at once, and never gets mixed with "Part 2."

Well made assembled drawings are bad enough, but when they are really bad they become "cuss"-producers.

One handed the writer not long ago was considered a fine production, yet when an attempt was made to work from it, about everything which could be measured was nicely figured, but where scaling was impossible not a figure was to be found. On one part were instructions to "bore" a hole to a certain diameter; if this had been done quite an amount of time would have been thrown away, as the party did not mean that the hole should be bored, but that it should be drilled; the fact that carpentering was the trade of the customer accounted for the expression. Why a carpenter and a machinist should call the same operation by different names is strange.

There is no reason why detailed drawings should not be given to estimate from in 99 cases out of 100; there is no saving of money, as they must be done some time, and if made by the manufacturer must be paid for, as he cannot afford to make them for nothing, even if they are suffered to be thrown in.

Let us have "detailed" and good drawings, and much less trouble will be met by the customer or manufacturer.

A recent dispatch from Glasgow is to the effect that there was some kind of an explosion in the tunnel of an underground rail road in that vicinity. And this statement is seized upon by the opponents of underground rapid transit in New York City. By those whose interests lead them to oppose such a means of quick transit, this account from Glasgow appears to be conclusive. How would it do to draw a parallel? As for example, a steam boiler exploded not long since, down in Pennsylvania; therefore we want no more steam boilers. There is about the same argument in one case as in the other.

The silk manufacturers of Paterson, N. J., are arranging to have a New Jersey exhibit of the silk manufacturing industry at the World's Fair at Chicago. The State Commissioners and the American Silk Association are encouraging the project.

Machine Design.

BY PROF. JOHN E. SWEET.

Is it not rather to be deplored that the same freedom of discussion does not exist in regard to looks in machine and engine design that obtains with matters that are purely mechanical?

Among the members of the Mechanical Engineers, as shown by the discussions, one may advance some theory, or describe his way of doing a thing, others object, dispute, or criticise with freedom and without giving offense; but when we come to a question of design, including right and wrong and looks, there seems to be something about it that the man who always approves of the design, however inappropriate or unsightly, is the one who makes the fewest enemies.

Designs, it seems, are not adopted because they are right, half as much as because things made in a certain usual way sell.

Lathes and planers made in the regulation style are about as near alike as two peas, and whoever should undertake to make them differently, however much better, would make either a howling success or a wailing failure, and which, would depend on the standing of the firm; and at present it is doubtful if any one firm has such a standing that they could make any radical change and get more credit than ridicule, or more sales than slights. Designers or builders follow the fashion, and the fashion is established usually after some marked individual success, and, too, almost universally the followers, in attempting to disguise the origin, or to essay an improvement, miss the essential or ruling characteristics, showing that those who do not possess the ability to produce original designs had better follow copy, or, if changes become advisable, to remember that it requires the same, and sometimes more talent, to make a change that will not be a disfigurement than to produce the original.

As an evidence of the truth of the above statements, it is only necessary to trace back the growth of the modern planing machine, and note the deviations from the bold sweep of the stanchion of the Sellers, which not one of the imitators or improvers have at all approached in looks or correctness; and the reason they have not approached it in looks is exactly because they have deviated from what is right. Precisely the same thing can be said of the Bement post drill. Of the half hundred imitators, none has approached that one most beautiful of all machine tools man ever saw.

In engines, to even greater extent and more plainly, peculiarities of design are shown. While the design of the Corliss engine bed was as applicable to slide valve engines as the original type, no one seemed to adapt it to that class, nor for some years after the Corliss patents expired was there a rush to build the Corliss, or the Corliss improved. So far as the looks of the frame is concerned, the writer, to his own thinking, has never seen one that equals the original, and the worst failure of all is Mr. Corliss' own attempt to improve it; and this only emphasizes the statement that it may take greater skill to modify or change a good design, and not spoil it, than it does to develop the original.

In the thirty or forty improved Corliss engines, the improvements where they exist

are more in mechanical or constructive details than in improvement in looks. When an improvement is made in that direction, it will be when some one finds where that is constructively wrong, and corrects it. When one can make what he knows to be constructively wrong look right to him, it is time his taste was cultivated.

The Porter-Allen engine bed was as much of a creation as the Corliss. It has, like the Corliss, imitators and improvers, but on the whole has never been improved, though there may be room for it, because it is not quite right. While the overhanging cylinder is abundantly able to carry its own weight, there is no earthly reason why it should, nor does it look right that it carry itself and the steam and exhaust pipes; and the design that projects out the unsupported cylinder and pipes, with an extension piece and another cylinder loaded down or propped up with its pipes, needs a vivid imagination, or the absence of all conception of right and wrong, to make it look right.

Manufacturers of machinery who procure their designs by appropriation seem to judge of the merits of different articles on the market by the financial prosperity of the makers; but as financial prosperity depends so much on other elements and so little on design, the gauge is not altogether a reliable one, and is certainly one that hinders the dissemination of correct ideas. This may not have been wholly true in regard to the Porter Allen engine bed, but engine builders a few years ago had but three general types to choose from; the square bed, the Corliss and the Porter-Allen; neither have they now but those with their mixtures, and their modifications, unless they dovetail in the Straight Line, which scarcely leaves much room, except to copy; for when a line is straight there seems to be no way to make it more so; whereas, the variations curves can be worked into are infinite.

Straight lines in machine framing are nothing new, as the wood framing of early machines were straight from necessity; but the straight line member introduced in the modern engine is based on a principle that it is, for the place, right, and as this straight line is a leading characteristic of the machine, the other lines of the design are made straight, to harmonize with it. Wherever a straight outline is right it can be made to look right; but there are places where it is not right, and some designers of modern machine tools are using it where it is wrong and just as impossible to be made to look right as bad curves or curves in the wrong place are.

The stanchion of a planing machine subject to the pressure of the cut is subject to a strain somewhat like a beam loaded at one end, when the tool is at its highest point, but not exactly, so that, while the parabolic form is right for a projecting beam (if the beam is solid), it is not just right for a planer stanchion; and, too, the parabolic form is not necessarily right for the projecting knee of a milling machine, not only because the load is not uniformly distributed, but because the theory of a projecting beam implies that the beam is held absolutely rigid, while the knee is never held in a way to give that appearance.

A lathe bed projecting over the support is a projecting beam, and would, if solid, need to be of a parabolic form to be right, but being hollow the web forming the under surface is perhaps as rigid straight. Still, as the cored section implies that it is solid, and as either is strong enough, it is probable that the parabolic form is best and looks best.

Some recently developed machine tools, where the straight line has been made prominent, would look better if they were replaced by curves of exactly the right form.

Machines having but a single support of the shaper sort look right when that support has either straight or curved sides, though the column must taper in either case and the curves be just right, or the straight will look best. Everything in the form of a molding detracts from the looks and adds to the expense in cost and care. Many attempts have been made to put two or more of this same kind of support under a machine and still have it look well, but it cannot be done with more than one. If there are two or more, only one can be of this kind, and the other or others must run from the machine down, rather than from the floor up.

Many times machines are built very deep and still leave four or six inches between the bottom and floor, when the same money that makes and fits on the feet would continue the bed to the floor and make a cleaner and better appearing structure.

There are places where it becomes desirable to perforate a web, or some parts of a structure, either to lighten it, to support cores, or to let in light. It is a common practice to do this with the stanchions of planing machines. These look better or worse as the best or worst form is selected. Eastlake says, "The hole or aperture should be the figure and not the material that surrounds it," and that is another reason why the Sellers make looks better than the others. A round opening weakens a web less and looks better than any other form.

So far, the above statement and argument relates to the main features of machines, but every detail has a bearing on the looks, and needs the same care and consideration as the framing.

Brackets should grow out of and not look as if they were stuck on the main supports, and all that perform similar functions should possess the same characteristics. That is, if one is of oval section an with straight, circular or French curved outlines, the others should be made on the same general plan, and while nothing of utility should be sacrificed for looks, it is seldom if ever necessary to do that when the designer is equal to the occasion.

Carrying the idea of harmony to the end, it will be found that even such details as bolt heads and nuts look best when having the same style of finish throughout.

Engine cylinder jackets look better of cast-iron fitted in the way made prominent by the Buckeye Engine Co. than the cabinet makers' sort, not because they are more ornamental, but more appropriate, and the beautiful planished iron of the French and Swiss engines looks better still, and for the same reason. It is but the growth of the same education that has made us admire the steel color paint better than green, and the cored section and smooth surface better than webs and ribs.

In the foregoing the writer has endeavored to consider only that part of machine designing that embraces the question of looks, and, where possible, present reasons why certain forms and arrangements produce results more pleasing to the eye. When the statements are unsustained by arguments they are but an opinion, and though at variance with the product of a large number, in fact of the largest number of well-established and eminently prosperous establishments, that is not positive evidence of their untruth. Manufacturers do not always build what they believe to be best. Many would change to the better were it not for the cost of the change.

The commercial side says let well enough alone, as it will be time enough to work for glory after we get rich, forgetting that more often than otherwise it is he who works for a reputation that is the most prosperous in the end.

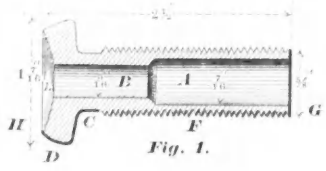


Fig. 1.

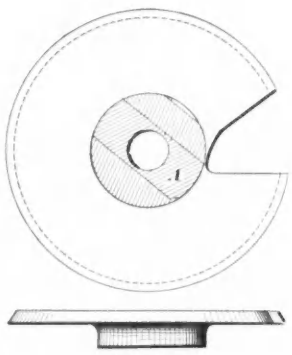


Fig. 2.

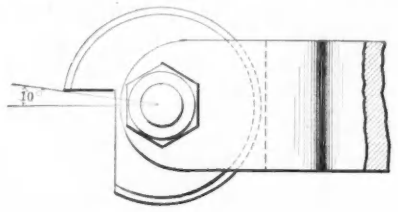


Fig. 4.

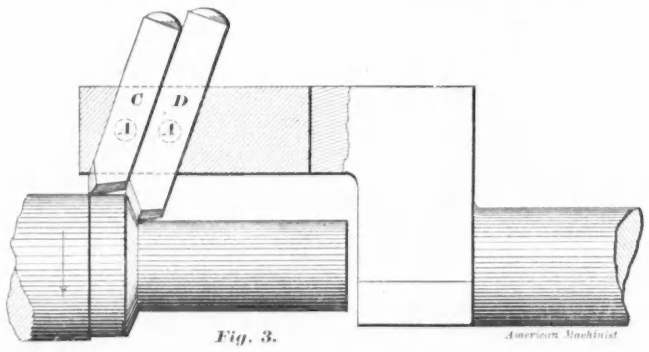


Fig. 3.

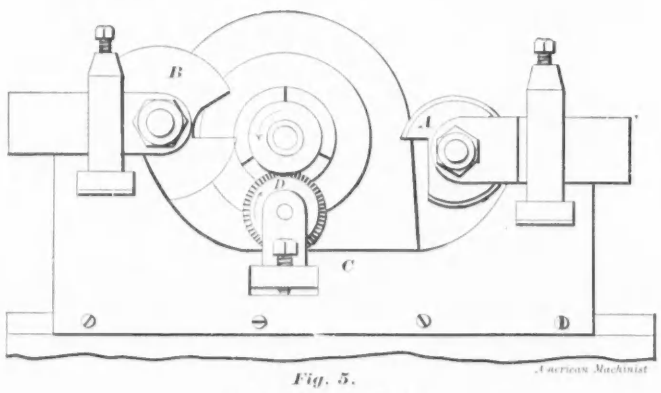


Fig. 5.

AN AUTOMATIC SCREW.

An Automatic Screw.

BY A. D. PENTZ.

Given ten thousand screws to be made just like sample shown in Fig. 1, and an automatic screw machine, I would be governed by the following facts and methods.

The cutting-off tool is first to be considered, because its thickness must be added to the distance the rod is fed. In fact, the rod must be fed the length of the screw, plus the cutting off tool, plus a trifle to finish the end *G*.

The cutting-off tool in this case may practically be one-tenth of an inch thick, and if the feed has an actual throw of two and five-eighths inches it will be right. This tool should be forged to shape and turned. After it is tempered it should be ground true. The edge angle is about 60 degrees. It is made thus to leave the "tit" on the rod. This is the best cutting-off tool for this purpose I know how to make. The end of the hub *A* is "file-cut" for grip. This tool is held to a shank by a bolt, or within a fork like the shape tool hereafter shown. If held to a shank, the screw should be left-hand in the case shown, and in every case, so that the strain of cutting shall tend to tighten the hold.

Where the screw is as stiff as this one it is preferable to reduce the stock by a tool in the turret. The one shown in Fig. 3 is a good one. Hollow mills are not satisfactory, because of the difficulty of sharpening them inside. The scaling cutter *C* will be found to have a two-fold value. It cuts off the rust and scale, and also makes the rod true, so that the reducing cutter *D* shall have an even depth of cut. Much rounder and more concentric results follow this arrangement than where but one tool is used.

The screw is formed to size by the shape tool, Fig. 4. No description of this tool is necessary, except the fact that it is set on the back end of the slide, and cuts downward, *i. e.*, the chips fall directly away from cutting edge, which is inverted. In both this tool and the cutting-off tool the edges are set 10 degees off the center, for clearance. This rule will work better than the empirical one-quarter inch rule of some shops. This kind of tool may be worn and sharpened on an emery wheel around the whole circumference, until it is all consumed.

It will interest me very much to discover who first applied the circular shape tool to practical work. I first saw it in the works of the McKay Sewing Machine Association in Lawrence, Mass., in 1867. It was an old appliance with them at that date. Perhaps some person may know who made and used this tool first.

After the shape tool has done its work, and the blank is of correct size, and after it has retreated a distance to warrant, the die must be in progress, and if the size of the screw is important, the cams or screw that control the turret must be very carefully adjusted, and must feed the turret precisely as fast as the die cuts the thread. Also in the reverse the die must be assisted off as carefully as it has been fed on, in fact, more carefully, if possible. The die must be *carried* both ways. It must not depend on the thread it has made for progress; if it does, the screw will be taper, or uneven in size. It will be seen by every mechanic that in backing a die off a screw, if the screw itself be the motive power, that the thread will be shaved on the driving side. Even the friction in the die clutch makes a difference. And when the die is partly off, if there be not a perfect support, and a careful taking away of the die, the end threads will be under size. But when everything is in dead line, and the progress is equal to the pitch of the screw in both directions, work can be practically made to .001 inch limits, in sizes below ¾ inch.

Make blanks a trifle small. A new sharp die will not draw a thread up much, but as it gets dull this tendency increases. In some cases this will amount to ten per cent. of the pitch. When a die is crowded with too big a blank the screw will be twisted and

change the pitch, or the die will be retarded, with the same result.

A second "sizing die" is of doubtful economy. It is better to cut the screw right at first.

After the screw in Fig. 1 is threaded, it must be knurled on *D*, and then it is cut off. While being knurled, the cross-slide *C* is traveling over, taking the shape tool *A*, Fig. 5, further away from the work, and bringing the cutting-off tool *B* into position to do its operation.

This method of knurling is patented to Messrs. Miller & McDougal. It is shown here without their knowledge, and only because it illustrated a saving, in that it operates by using an idle motion. I know also this method does good work.

There is no attempt here made to identify these suggestions with any screw machine known. But the endeavor is made to give good practice, that, as far as possible, is applicable to all automatic screw machines of whatever make.

The screw in Fig. 1, it will be seen, is not yet finished. The hole *B* and the countersink *E* are neither of them made. Now the hole *A* is a clearance, and is not particular except that it be larger than the hole *B*, and yet not big enough to weaken the screw outside it. But, on the contrary, the hole *B* is very particular in size, and it must be concentric to the screw thread. Therefore it would have been unsafe to drill it from the bottom of the hole *A*. The recess *E* cannot well be made until the piece is cut off.

The most reliable way to make a good and concentric hole, as *B*, in this screw, is to carefully make a concentric screw chuck in the spindle of turret lathe, and screw these pieces in by hand. When they run true with the head outward, it is a very practical operation to drill and ream the hole *B* true, and to cut the recess *E*.

Condition and Prospect of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

Brown & Sharpe Manufacturing Company (Machinery and Tools), Providence R. I., write us:

The sales of our machine tools have been eight and one-half per cent. less in value in 1891 than in 1890. The number of hands employed at the commencement of the year was 1,000, and is now 727. The buildings have not been increased, but forty-nine machine tools have been added to the plant.

The prospects of business during the coming year seem to us to be good.

The Billings & Spencer Company (Machinists' Tools and Drop Forgings), Hartford, Conn., write us:

We are much pleased with the result of our past year's business, it having exceeded that of 1890 by thirty per cent. We have made extensive additions to our plant, and are now running in the forging department forty-three hammers. We have also increased our machine shop facilities by adding some heavy tools, such as a 48-inch planer, 10-ton crane, radial drill, etc., and are now in a position to do our own repair work or manufacture our own hammers. We are constantly in receipt of large orders for copper and bronze commutator bars for dynamos and motors, and our product in this line seems to meet with unqualified success. We are very much pleased with the sales of our new line of fine machinists' hammers and machinists' tools in general. We think the outlook for the coming year as promising as it was a year ago.

John Wiley & Sons (Publishers of Scientific Text-books and Industrial Works), New York, write us:

We beg to state that our business this past year has been most satisfactory.

The growing demand for technical and industrial literature gives evidence that the practical mechanic has become a reading man, and we benefit accordingly.

That we appreciate the efforts of the AMERICAN MACHINIST in this direction is shown by the fact that we have in preparation two books which have run through the columns of your paper.

One of our first books of the new year will be "Dingey's Pattern Making," and the constant inquiry for "Meyer's Modern Locomotive Construction" would seem to indicate that its merits are appreciated.

This latter book we hope to have ready in April.

Among our successful books of the year we may name in mechanical engineering "Thurston's Manual of the Steam Engine"; in civil engineering, "Foster's Wooden Trestle Bridges"; in general science, "Merrill's Stones for Building and Decoration," and in industrial science, "Bucknall's Smith's Wire, Its Manufacture and Uses," and "Birkmire's Architectural Iron and Steel."

We would like to add that our advertisement in the AMERICAN MACHINIST has been one of our most successful ventures.

The phrase, "I saw your advertisement in the AMERICAN MACHINIST," has become monotonous, it has been so often repeated.

Darling, Brown & Sharpe (Manufacturers of U. S. Standard Rules, Patent Hardened Cast-steel Try Squares, and a Variety of Tools for Accurate Measurement), Providence, R. I., write us:

The demand for our tools still continues to be in excess of our ability to supply them, although considerable additions have been made to the plant during the year. The prospect for business in 1892 seems to be fair.

The Defiance Machine Works (Hub, Spoke, Wheel, Bending, Wagon, Carriage and other Wood-working Machinery), Defiance, Ohio, write us:

Our business for 1891 has been very satisfactory to us indeed, and the prospects for the coming year are even brighter. We have added new machines to our equipment, increasing our capacity fully one-fourth within the past year; have just placed in operation in our works a 200-light Edison incandescent electric dynamo, which is driven from a 150 horse-power Brown automatic engine, which we put in about six months ago for driving our machinery. We think the prospects for business for manufacturers in the States for the next few years is very encouraging.

Gould & Eberhardt (Machine Tools), Newark, N. J., write us:

We are still quite busy in our various specialties, employing over 200 hands, which is more than we had last year at this time.

The prospects of business for the coming year are not so bright as could be wished, but we think it a favorable time to build, and therefore are adding 120 feet to our main building, which will then have a length of 290 feet, and four stories high, and also a new foundry, with latest known improvements, having 8,000 square feet under slate and iron roof. This foundry we are trying to make one of the most *healthy* for workmen and most convenient to do *our* work.

We are continually elevating the standard of our plant and output, at the same time improving the quality of production, and reducing the cost where we can by the use of new methods.

We have enjoyed a constantly increasing demand for our well-known special tools throughout the past ten years, and although we have not as many orders ahead now as we have had some times during the past year, we hope to still merit the increasing trade which we purpose to prepare for receiving.

Barr Pumping Engine Company, Philadelphia, Pa., write us:

Replying to your favor of December 9th, would say that our business for the year just closing has been in every way satisfactory to us.

For two years past our business has been largely with the iron and steel industries; there is a little lull at present in these trades, so that, for the present, we are not doing as much in either one of these lines as last year. Our present volume of business is not so large as six months ago, but inquiries are numerous, which seems to indicate that we shall be busy after the first of the year. Last winter we were obliged to run overtime, and, in some departments of our works, all night, which is a little more business than we care to have, but we like to keep the shop full without the necessity of working overtime. The present outlook we consider to be quite encouraging.

New Doty Manufacturing Co. (Hand and Belt Power Punching and Shearing Machines), Janesville, Wis., write us:

Our business for 1891 has not been as good as we had hoped and judged it would be, from the previous year's business. From June to November it fell below the same period in 1890. We do not fully understand the reason for this, but from reports received from our correspondents in different parts of the country we have been led to believe that we did not suffer alone, and that the machine business generally was dull at that time. Business began to improve about November 1st, and has been steadily improving since then. At present we have plenty of orders, and the inquiries we receive indicate a good volume of business after the holidays. We have during the year made no changes in the price of labor, though we think we could have cut it down slightly, during the dull period, if we had been inclined so to do.

Frick Company (Eclipse Machinery, Corliss Steam Engines, Ice Making and Refrigerating Machines, Steam Boilers, etc.), write us:

Your favor of the 9th instant received. We are constantly increasing our facilities. Our trade in Corliss engines, especially the larger sizes, including compound engines, together with ice machines, has increased. We have added largely to our facilities during the year; there has been no material change in price, labor, product or material, although at present writing raw materials are very abundant and offered at lower figures than have ruled for some time past.

The Long & Allstatter Co. (Power Punches, Shears and Agricultural Implements), Hamilton, Ohio, write us:

Replying to your letter of the 9th—during the past year we have found it necessary to double the capacity of our foundry, making an extensive addition to the building, putting in heavy steel crane, enlarged cupola, etc., besides enlarging the blacksmith and machine shop, to meet the demand for a heavier class of tools for special work, particularly in the line of what is called "labor-saving machines," such as those required for punching a larger number of holes at one time, up-setting a number of rivets at one stroke, punching and shearing machines with hand and automatic feed spacing tables attached, belt and steam driven, etc. We have brought out a number of new tools for special work of this kind. There has been a marked increase in the number of orders received during the past three months over previous parts of the year, and the outlook for 1892 could not be more satisfactory. The first part of this year was not up to the average of the year previous, but the increase in the latter part will bring the average up to a very satisfactory figure.

The E. Horton & Son Company (The Horton Lathe Chuck), Windsor Locks, Conn., write us:

We are pleased to state that during the past year our business has been exceedingly good. We have sold many more Horton Lathe Chucks than ever before in any one year. We have extended our trade relations and are constantly filling orders from all parts of the world. With us the prospects are good for a prosperous business the coming year.

Lexington Gear Works, Lexington, Mass., write us:

Our efforts for the past year have been principally directed to the introduction of our ready-made list iron gears, and our chief object for the coming year is the same.

We believe that the ready-made gear is as much of an improvement in its line as the ready made screw is over the made-to order article, and that it will be in general use when machinists once get into the habit of using it, of adapting their plans to suit it, and understand that it is not only as good as, but also cheaper, and can be procured much more quickly than when made to special order. We have very greatly enlarged our list for our new 1892 catalogue.

We are now located wholly in Lexington, Mass., having no office in Boston or other place.

A. R. King Mfg. Co. (Foundry and Machine Works, Heavy and Light Castings in Iron, Brass and Composition), Jersey City, N. J., write us:

We are pleased to state that our business for the past year has been very good, having increased about 25 per cent. over the year previous. We have added a number of new tools to our machine shop, and put in an arc light plant for lighting throughout. At the present time we are quite busy, although new orders are a little scarce. We look, however, for a good business after the first of the new year.

The Bradford Mill Co. (Machine Tools), Cincinnati, Ohio, write us:

We have increased our plant, and consequently our output, very materially, and our business has improved correspondingly. We have worked full time right along and run overtime for several weeks. Business is not as crowding as it was a few months ago, but we have orders for all we can make, and are not getting any stock ahead. As to the outlook, we hardly know what to say. We have no men on the road, and are not prepared to answer as to the general feeling—our own experience is perfectly satisfactory to us, and with the fine crops of last summer we don't see any reason why a good business should not be expected in '92.

The Pratt Chuck Co. (Drill Chucks), Clayville, N. Y., write us:

Our business has been of a satisfactory nature the past year. Our orders, largely from advertising through your paper, have kept up with our production, and we are now preparing to increase our output.

J. T. Slocomb & Co. (Light Tools and Machinery), write us:

We have not yet been in business quite a year, and as our business is wholly a new venture, and as about all our time so far has been expended in making tools and experimenting, we cannot say with any great certainty about the future now, but the prospects to us look good.

We started to manufacture small counterbores or countersinks, combined with short drills, for drilling and countersinking or counterboring at one operation.

For any case where the cost of the steel is a small item, and where it is necessary to keep the counterbore to some particular form, we believe we can furnish such tools new, cheaper than such tools are usually sharpened.

We are in hopes to accomplish something during the year of 1892.

Westcott Chuck Company, Oneida, N. Y., write us:

During the year now closing, the sales of this company have been larger than in any previous year of its history. Domestic and foreign trade have both increased. During ten months of the year, factory was in operation twenty-two hours out of every twenty-four.

There has been no change in prices, and collections have been good.

Have issued our catalogue in French and German, and circulated same extensively. Have added some larger sizes to our lathe chucks, and taken measures to greatly increase both lathe and drill chucks in strength and durability.

Bluefield Iron Works (Mining and General Machinery), Bluefield, W. Va., write us:

Our trade during the past year has been a considerable increase over the previous year's business, and the prospect for the coming year seems to assure us of a large increase over what we already have done. The demand for our specialties increases faster than the growth of the country throughout this section, and although we doubled the capacity of our plant during the past summer, yet we will be much cramped for room when the spring trade opens up.

While tight money has checked the growth of many industries in this section, we only suffer a little inconvenience, and no diminution of trade.

The Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa., write us:

We are pleased to say that our business for 1891 has shown a healthy increase over that of the previous year.

Old customers have continued with us, and many new ones have been added. Our foreign trade is increasing nicely, and we expect that 1892 will show a large increase over the business of this year.

S. M. York (Machinery and Engineering), Cleveland, O., write us:

Although the past year has aggregated almost as much business with us as any former year, the amount of profit has been less satisfactory than any year since '87; but from present indications, and the amount of inquiries and interest in machinery and tools, we would look forward to a very prosperous and thriving new year. It would seem from the knowledge which we can glean in advance that it is hardly possible for buyers to hold off as they have been doing for the last six months. Shops in Cleveland are rather quieter than they have been for some time.

The Berlin Iron Bridge Co. (Engineers, Architects and Builders of Iron Bridges, Iron Buildings, Iron Roofs, etc., etc.), East Berlin, Conn., write us:

We have no fault to find with our business during the past year as regards quantity, but prices have been very low—however, did you ever know of a manufacturer who was not always growling about prices? We have done a business in iron bridges and iron buildings of $1,000,000, which is about 20 per cent. larger than any year heretofore, and while we have had no very large con-

tracts, still we have had an unprecedented number of small contracts. There has not been so much call for our class of work in new enterprises as in making changes and revising old manufacturing plants. A great many of these have taken advantage of what might be called a slack time during the last year to make changes and build new additions, and this has called upon us for a large amount of our class of work.

For the year of 1892 we have little or no anxiety, as we believe that business will take care of itself.

Unprecedented crops at home, and an almost unlimited demand abroad, are sure to make good business in this country, unless Europe continues to unload her railroad stocks and bonds on us in payment for our crops. In that case we fail to see where we are going to get any substantial benefit from our exports. If, however, we can draw foreign gold to our shores, which we seem likely to, then we can count on plenty of money, and with the increased earnings by the railroad companies we see no reason why 1892 should not be a banner year.

Jones & Lamson Machine Co. (Turret Machinery, Flat Turret Lathes, Screw Machines and Turret Lathes, Complete Outfits of Turret Tools), Springfield, Vermont, write us:

We would say that a year ago we stated that we had placed upon the market a 2x24 flat turret lathe; the demand for this machine has far exceeded our most sanguine expectations, as the fact that it represents over 60 per cent. of our sales for the year demonstrates.

Since it was first illustrated and described in the AMERICAN MACHINIST, we have kept it before the public in your advertising columns, which accounts in a large measure for its rapid introduction.

The call from all parts of this and foreign countries for our publications illustrating and describing this machine, entitled "Rapid Lathe Work by a New Method," has compelled us to issue a second edition this year.

We have added to our line of turret machines a large chucking lathe, and have remodeled our 8" and 11" machines, greatly increasing their capacity.

An increase in the capacity of our works has been made by the employment of 25 per cent. more men, and the purchase of many new machine tools. We have also added largely to our jigs and special tools.

We know that the year has been reported as dull for machine tool builders in general, but we have run on full time the entire year, and have only just arrived where we can make prompt shipments of our regular machines, although we have no machines in stock. We have no fears for 1892, from the present outlook.

The Cincinnati Milling Machine Company (Plain and Universal Milling Machines and Universal Cutter Grinders), Cincinnati, O., write us:

We are pleased to be able to report that our sales for 1891 were the largest of any in the history of our business, during this year having sold quite a number of our machines in the foreign market. Although trade has been quiet with us during the past two months, we are hopeful of a good year coming. Already a better feeling is manifest, and especially during the past week inquiries and prospects for orders have been good.

During the year we bought a corner lot of 120x133 feet, and built a two-story brick building of 50x133 feet. The shop is perfectly lighted, there being no obstruction to light on either side. The Buckeye Engine Co., of Salem, Ohio, furnished the entire steam plant of their latest and best pattern, the B. F. Sturtevant Co., of Boston, one of their hot blast heating apparatus for heating the building. Have added a new 36" double head Gray planer, and a few smaller tools, and with the increased floor space our capacity has been very much increased. Will add several new tools in the near future. Have under way several new sizes of milling machines after a new design, which will be ready for the market soon. In closing, we cannot refrain from saying that we have very much felt the influence of our advertisement in the AMERICAN MACHINIST. Our investment with you has been exceedingly profitable.

Phoenix Iron Works Company (Manufacturers of High Grade Automatic Engines, Boilers and Heaters, Compound and Triple-expansion Engines), Meadville, Pa., write us:

While the volume of business in our boiler department has not been as great as in the year 1890, we have had, nevertheless, a healthy and satisfactory trade. Our engine sales have been greater than in any previous year, largely due, no doubt, to the success we have met with in our new compound engine. Every indication points to a large volume of business in the year 1892, and we are increasing our facilities to take care of an increased demand. We consider the outlook very bright for the future. We have not found it necessary to make any changes in our prices.

The Egan Company (Wood-working Machinery), Cincinnati, Ohio, write us:

We have to say that the year 1891 has been a remarkable one for us, in that we have had an increased trade with every section of this country, and have had a phenomenal success with our export trade. We look to see the year '92 to be as fruitful of results as the year now closing, and we are rather inclined to think that we have a right to expect a largely increased business, both in this country and abroad, even with the understanding that it is a presidential year.

We have just about finished enlarging our works, and have filled the new additions with the latest improved machines, and with the most modern appliances. There has not been any very great change in price of material, one way or the other.

Gisholt Machine Company (Turret and Engine Lathes, Universal Tool Grinders and Special Iron-working Machinery), Madison, Wis., write us:

The demand for our turret lathes is constantly increasing—so much so that we are laying plans for greatly extending our facilities for manufacturing them. We have fully demonstrated that very heavy work may be done on our lathes with rapidity and accuracy not before considered possible. We have recently received an order from a very prominent manufacturer of wood-working machinery for a machine and tools for making about sixty different pieces for his machines, such as gears, pinions, bushings, pulleys, etc. We have recently supplied several large manufacturers of steam engines with lathes for making various parts of engines, such as Corliss engine bonnets, glands, crank-pins, etc.

We are now perfecting plans to manufacture in large quantities turret lathes and screw machines, varying in size from 12 to 50-inch swing, making the line absolutely complete for making screws and studs up to 4½ inches diameter, and machining pieces that do not swing over 50 inches.

Our universal tool grinder is finding its way into many shops, and the demand increases as the machine becomes known. It would seem from our experience that the old method of grinding tools has about had its day in all the larger shops.

Buckeye Engine Co. (Buckeye Automatic Cut-off Engine, Throttling Engines, Boilers, etc.), Salem, Columbiana Co., Ohio, write us:

Our business for the year 1891 has been far beyond our expectations at the commencement of the year, notwithstanding the prospects were quite flattering at that time. The year has been an unusually good one for us, as we have been running full time—ten hours per day—the entire year, and about every other week thirteen hours per day, which was all that our workmen could stand. We have been compelled to increase the size of our foundry about one third, in order to facilitate the getting out of our orders. The sale of our products has been distributed pretty generally throughout the States and territories, as well as in some of the important foreign points. Judging from correspondence and inquiries, the prospect for business in our line during the coming year is very bright indeed; inquiries for our compound automatic cut-off engines have materially increased in the last few months, from which we gather that the tendency of the requirements of the engine-buying public is decidedly in favor of the use of such specialties, especially where large powers are required.

The Fox Machine Co., Grand Rapids, Mich., write us:

It gives us pleasure to report a prosperous year that is just closing.

Our output for 1891 is more than double that of 1890, and in order to meet this increase it has been necessary to add new tools in all directions, including a new Buckeye automatic engine, planers, lathes, milling machines, drills, etc.

We have done a large export business, having introduced our universal trimmers into all parts of the mechanical world, and, strange to say, even in the oldest mechanical countries, where they have made patterns for years, there was found nothing but the most primitive tools (such as the block and shoot plane) to do this class of work. It is hardly necessary to add that the trimmer has been gladly retained in these countries.

By building many special tools we have not only been able to reduce the selling price of our machine, but also to produce a better article, both as regards finish and accuracy of construction.

We have added to our list of manufactures a new iron-working tool, which is a cross-breed between a planer and a shaper, and which, for want of a better name, we call an open-side shaper. We are using three of these in our own works, which fully meet our expectations, and we look forward to a large trade in this line during the coming year.

In connection with this we shall soon place upon the market a line of plain milling machines, with both vertical and horizontal, single and double spindles.

While we think our success, by the permission of a kind Providence, largely due to our starting out into new fields with new and original machines, we do not lose sight of the fact that the character and co-operation of our employes have been factors in determining the result, and the fact that about fifteen of our apprentice boys have in the past year invested over $200 in personal tools shows that they have caught the spirit of progress, which, we think, has been stimulated by reading the AMERICAN MACHINIST.

We hand you the names of nine renewals, also twenty-five new subscribers to the AMERICAN MACHINIST.

L. W. Pond Machine Company (Manufacturers of Iron-working Machinery—Improved Iron Planers a Specialty), Worcester, Mass., write us:

Our business, in common with others in our line, has suffered somewhat from the depression prevailing during the past year, but while the volume of business has not been as large as in 1890, the results will prove fully as satisfactory. The outlook for a good trade in 1892 has seemed to us more encouraging for some time past, and we are looking for a large increase in business the coming year.

We have furnished some extra heavy tools during the past twelve months, planers being the only thing we build, and expect to supply our full share of those to be ordered during the next few months, of which there seems to be an unusual number wanted. Planers ranging in size from 48"x48" to 72" and 84" square, and weighing from 30,000 to 90,000 pounds.

Our facilities have been such that we could not handle the heavier class of work to advantage, but we are now moving our entire works into new buildings built expressly for our business, where we shall have every modern convenience for handling both light and extra heavy work. Our new shop is 150x50 feet, having four stories and basement with brick office building, and in connection with our own foundry, having a capacity of 20 tons per day. We shall be prepared to get out tools in quick time and at the lowest possible prices. Our new shop is located near the center of the machine trade of the city, adjoining lines of three railroads—the Boston & Albany, N. Y., P. & B., and N. Y. & N. E.—from which we shall have our own spur tracks, and our facilities for shipping will be of the best. Among the tools we are now building is a planer to plane 88" wide, 72" high, and 35' long, weighing upwards of 90,000 pounds, for our own use, and one to plane 60" square, 18' long, for Mr. William Wright, Newburgh, N. Y.

John Maslin & Son (Engineers and Machinists), Jersey City, N. J., write us:

We are pleased to state that business in our line during the year 1891 has been quite satisfactory. In addition to the large and increasing sale of our improved automatic steam vacuum pumps, we have also sold a large number of our improved balanced ball neck pieces, air valves, flat and ball rubber valves for use on old style pumps of this class. Our export trade also has far exceeded our expectations. With an additional line of larger sized patterns we hope to be able to meet the increasing demands for goods in our line.

Wm. Lowe (Proprietor of the Bridgeport Boiler Works, Bridgeport, Conn. The Lowe Boiler and the Lowe Feed-water Heater and Purifier, and all regular Stationary and Marine Boilers and General Boiler Shop Work), writes us:

Our business for this year has been as good as last year, and one of the best we ever had, but has fluctuated more than usual with us, which is neither pleasant nor profitable; these fluctuations seem to increase, and must be attributed to the general disposition of all parties to get their work all done at once, which undoubtedly is the cause of the unnecessary increase of facilities over a busy year's steady demands. As to prices, they have been too low, and now are lower than ever, *pro rata* to wages, and prices of plates and boiler tubes, which were never as low as now in our experience. Those needing or likely to want boilers or boiler shop work should buy it now.

The prospects for the coming year are not so promising for us at this time as last year, but we have fair expectations, and are now employing all our regular hands. We have gained patrons for the Lowe boilers and Lowe feed-water heaters and purifiers, and have sent them more abroad, into new localities, with very satisfactory and promising results. Finally, we feel that we ought to have a good year's business for 1892, and think we shall, as our facilities are generally employed by our many patrons, and, if we are favored with new ones, it makes us very busy.

Energy Manufacturing Co. (Manufacturers of Patent Machinery), Philadelphia, Pa., write us:

We have the pleasure to state that our shipments since April—when the present owners took possession—have increased over any made in same time. We credit this to advertising, improved facilities, improved goods, and the fact that our specialties are better known. We find payments slow, and believe business has generally been poor. From our increased number of inquiries, believe the coming spring will bring us a large volume of business. All of our goods are now made from entirely new and improved patterns. We have established agents in New York, Boston, San Francisco, Australia, and London, England. We have shipped a number of center grinders to latter agent, and at present have an order for one dozen from him. These are made with a square shank, to suit tool holders of their lathes. At present we have work that will keep us taxed for several months.

Boston Gear Works, Boston, Mass., write us:

Our orders for the year have been very encouraging, and business has been more steady than preceding years.

We are preparing a new catalogue, which we hope to have ready by January 30th, which will contain a list of a large assortment of gears kept in stock.

Our noiseless fibroid gears are meeting with success, and we inclose a statement of the *Electrical Age* which will give some idea of the new material.

We have facilities for furnishing spoked sheet brass gears of all standard sizes, up to 6" diameter, of any desired thickness.

We are preparing a list of worm gears and chain wheels which will contain a large assortment, both very large and small.

Our list of brass gearing for 1892 will be the most complete one yet published.

We find that there is a great demand for our gear book, which contains much valuable information for mechanics.

We look forward to a successful line of trade for the year 1892.

J. A. Fay & Co. (Wood-working Machinery), Cincinnati, Ohio, write us:

During the year just closed our business has been of sufficient volume to enable us to employ our entire force ten hours per day. For a portion of the year we added some twenty-five to the number that we employed last year. Our foreign trade has steadily increased, and our home demand has been larger in some branches, but there has been a slight falling off in others. Our largest shipment this year to a foreign country consisted of a complete outfit, amounting to seven full car-loads of machinery. We have purchased two large buildings adjoining our works, formerly occupied by The Lane & Bodley Co., where they manufactured their Corliss engines (they have erected a large addition to their regular shops). This addition contains an acre of floor space on a level with our other buildings, and by cutting doors through the walls we were enabled to add this to our plant. We use these buildings as warerooms, and for shipping. They are so situated by the railroad track that we are able to load our machinery directly into the cars at our own door, making a very great saving in drayage, and the expense of sending our men to the freight yards, as we formerly did. We have added several very important labor-saving machines to our list of tools, and have improved many of those we have manufactured heretofore. Our works now occupy the greater portion of a double square on Front street, extending through on John street to Graham alley, and from Graham alley to Water street. With this large addition, and with the help of improved systems and new tools that we have introduced during the past year, we hope we shall be able to keep up with the demand for our wood-working machinery.

P. H. & F. M. Roots Co. (Blowers, Forges, etc.), Connersville, Ind., write us:

We have had an extraordinarily good business during the past year, and the prospects are good for the coming year. We have not made any improvements or enlargement about our works.

J. P. Richards (U. S. Standard Punches and Dies for Punching Iron and Steel), Providence, R. I.), write us:

Business has been very steady the last year. Quite a number of shops have adopted the U. S. standard for punches.

I have added two sizes more to my list, and now make shearing punches, with spring centers, from 2 to 4 inches diameter.

A few boiler makers are using my shearing punches for cutting out tube holes, and I have the testimony of their doing excellent work. I have changed the name to U. S. standard, as it is the only correct standard ever made for punches from ½" to 4" diameter, and I expect the whole country will adopt it as soon as they can see the great value of a uniform standard for punches and dies.

Cooke & Company (Engines, Boilers, Machine Tools, Shafting, Hangers, Pulleys and General Supplies), New York City, write us:

The volume of our business has been large, but margins have been close. It has been an important year to us on account of our moving our business to a new locality, and we find a great advantage in our largely increased facilities. We have introduced machinery for fitting up shafting, couplings, etc., on our own premises, and find that by carrying a complete stock and being able to make quick deliveries we are working into a very nice trade in this special line.

Unless politics prove to be a disturbing element in business during 1892 we look for one of the most prosperous years we have seen in a long time.

Fitchburg Machine Works (Metal Working Machinery), Fitchburg, Mass., write us:

For the year just closing we have had a good average business, but there has not been the push and drive which was experienced by nearly every one in 1890. We have employed our usual number of men and have run full time.

We have made many changes and improvements in our tools in the past year and we expect to continue in the same line for the year to come.

At the present time there is the usual quiet which is expected just before the new year; we expect a good amount of business for the year to come. In the last six months we have had a large amount of government work, which is now nearly completed; the present falling off in new business which we now experience, in common with others, will enable us to build a few tools for stock; for the past two years our orders have been equal to our capacity.

We have just issued a new catalogue, which we propose to put into general circulation, and we trust that this, in connection with our advertisement in the AMERICAN MACHINIST, will enable us to get our share of business for 1892.

S. A. Smith, Manufacturers' Agent, 23 South Canal Street, Chicago, Ill., writes us:

The trade in small tools and supplies has been good, but the machinery trade has been very erratic; still, we have sold more machinery this season than last. There are a number of new enterprises under way in this city and vicinity, and I think the outlook for next season is good; consumers have ordered this season only as they wanted, consequently very often, and the season will pan out better than expected.

W. D. Forbes & Co. (Engineers), Hoboken, N. J., writes us:

As we are not yet a year old it is hard to say what we will do in the future, but our plan is to add greatly to our plant in '92, as work on hand and to come shows us we will require more tools. We are at work on several machine tools, but may not put them on the market before '93. We are well pleased with our outlook.

Heber Wells (Printers' Materials), New York City, write us:

The year generally has not been good for business, and it is to be hoped that 1892 will be much better.

The Superior Machine Works (Manufacturers and Designers of Light and Heavy Machinery), Cleveland, Ohio, write us:

Our business for 1891 has been one-third greater than last year. Removing to our present quarters April 1st, we have twice the floor space formerly occupied, and being equipped with modern tools we keep abreast of the times, and a little ahead in our line.

Among new tools built this year are several power shears for cloth or other fabric, with automatic adjustable feed, the length of cut varying in the different machines from 40 to 120 inches, and at an angle of 45° to line of feed. The new automatic gear cutting machine, just patented (Dec. 1st), we believe will take care of 1892, being engaged at present exclusively on these machines.

L. S. Starrett (Fine Mechanical Tools), Athol, Mass., writes us:

In regard to my business, the past year, like preceding ones, has witnessed a continued growth. I have added several new tools to my former list of manufactures, and have put in several new machines to facilitate work—among them four automatic screw machines and a Brown & Sharpe universal grinding machine.

I was troubled during the summer months by low water, not having enough to drive my works, so put in a Westinghouse engine as an auxiliary to help out. Now, however, I have sufficient water to run without its help.

The most encouraging and pleasing feature of my business is the frequent unsolicited acknowldegment by both mechanics and dealers of the excellent quality of my tools, they being preferred to other makes.

Just at the present time, as usual during the holidays, trade orders are not so heavy or frequent, but I am anticipating a rush later on, and am preparing to meet it.

I have recently had a large edition of catalogues printed, showing the new tools referred to. Every mechanic wants one, and they are being called for from all directions, far and near.

Charles P. Willard & Co. (Portable, Stationary and Marine Steam Engines and Boilers, etc.,) Chicago, Ill., write us:

We are happy to be able to report a prosperous business for the past year, and we regard the outlook for 1892 as exceedingly promising.

The material prosperity of the country as a whole has never been equaled.

During the past season we have, in addition to our usual production of portable, stationary and marine engines and boilers, shipped small steamboat machinery to British Columbia, Alaska, Australia, South America, West Indies, and to Siam. In several instances we have competed successfully against German and English builders, and are happy to say that, so far as we can judge from our own trade, American steam launch machinery seems to be regarded with favor by foreign buyers.

The coming year we shall produce, in addition to our former line, a full line of small compound engines, both fore-and-aft and steeple or tandem type, ranging from 15 to 100 horse power.

Sibley & Ware, (Iron Founders and Machinists), South Bend, Ind., write us:

We found business satisfactory during 1891. We have added several new machines, and the prospects for 1892 look very favorable from our standpoint.

Trump Bros. Machine Co. (Light Machinery, Finished Hexagon Nuts, Stud, Coupling and Tap Bolts), Wilmington, Del., writes us:

From January to October the volume of our business was in every way satisfactory, largely in excess for the same period of any previous year; since October it has fallen off, but the indications for 1892 are very encouraging.

We have added during the year new buildings (increasing our shop room about one-third), and a considerable number of new tools, among which are: One Brown & Sharpe universal grinder, one Garvin profiler, one Lodge & Davis chucking lathe, and a number of Muller lathes, and some tools of our own design and construction.

Cost of labor has advanced; material is about the same as last year.

The Henley Machine Tool Works (Iron-working Machinery, etc.), Richmond, Ind., write us:

Our business for past year has been satisfactory. Increasing demand for pulley lathes made it necessary for us to enlarge our works for the manufacture of this special machine. We have just completed and are occupying a 42x150 feet addition to machine shop, and have put in a large amount of valuable machinery during the year, and our facilities are now sufficient to keep up fairly with orders. Prospects for business for 1892 are good; prices of material are a trifle lower, product remaining about same; cost of labor and wages have advanced.

Millers Falls Company (Hardware Manufacturers), 93 Reade Street, New York, write us:

For twenty-five years there has been a steady yearly increase in our business, and the year 1891 has been no exception. So far as this country is concerned, we believe the demand for mechanics' tools has been about the same as last year; but the foreign orders have been much larger. These orders make our December sales the largest of any month in the year, while at the beginning of our business, December was the dullest month. Our Star Hack Saws have worked their way into most machine shops the world over, and now our new power frame for them is fast following the blades wherever they have gone.

Like all other makers of new and improved tools, we find it a work of much time and large outlay of money to bring them to the notice of the men who are to use them. But we also find that if the tool is really good, and will give satisfaction to the purchaser, a judicious amount of advertising in such papers as the mechanics read will surely bring a demand in due time. We expect that the home trade will be larger in 1892 than it has been this year, and are governing ourselves accordingly.

W. S. Rogers (Mechanical Engineer), Troy, N. Y., writes us:

My business for the past year has been very satisfactory. I have discovered that drawing stands, to be "sellers," should be neat and tasteful in design and finish, with none of the crude angles and corners peculiar to "the shop." Consequently I look forward to a prosperous year of business.

Ferracute Machine Company (Presses, Dies and other Sheet Metal Tools), Bridgeton, N. J., write us:

Our business during the year 1891 has been of about the same volume as in the past year or two, or perhaps the sales amount to somewhat more. We formerly built considerable automatic machinery, but this year decided not to do so, and have confined ourselves to standard presses and dies, etc., to a great extent, which has some what lessened our volume of trade, but has given us a greater amount of standard, and consequently more profitable work. We have added one new building—an extension to our erecting shop, and considerable new machinery. Among other tools, we have put in two large planers, a large boring mill, several drill presses, milling machines, shapers, etc. We have also improved and increased our small tools considerably. We are just introducing some new lines of cutting presses, and also some drawing presses, which will be built from much better designs, and heavier and better in all respects, than our former machines of the same class. Trade during the year has been steady and good. It is a little quiet just at present, as usual, but we look for a good trade after the middle of January, and shall probably greatly increase our output next year.

Acme Machinery Company (Bolt, Nut and Special Machinery), Cleveland, Ohio, write us:

Our business during the past year has not been quite as large in volume as during the previous year—the output being about five per cent. less.

There is, however, a better demand again within the last two months, and inquiries are quite numerous, so that we think the prospects for a good trade in 1892 are very encouraging.

We have added several more machine tools to our facilities during the past year, mostly of our own design and make, for our special work.

There has been but little change in the cost of material, and wages remain about the same.

Worcester Machine Screw Co. (Standard Machine Screws), Worcester, Mass., write us:

We have nothing specially new to note. While the volume of business during the past year is not quite up to 1890, yet we have been fairly busy.

We have added some new machinery during the year, and are now building more.

The price of labor has not changed, and the material which we use, iron being the largest item, has not materially changed in price. While we could buy common refined iron at a very low price, the price of the iron which we use in the manufacture of our goods has kept up to about the same prices as in 1890.

The prices of our product have been well maintained, with the exception of what is commonly termed machine screws, which are very low.

We think that the outlook for a good business the coming year is very flattering, and we look for a general revival in the iron line.

Hugo Bilgram (Engineer and Machinist), Philadelphia, Pa, write us:

The past year of 1891 has been with me one of unusual activity, not only in my bevel gear cutting department, but also in the department for the construction of special machinery.

Before the year was far advanced I found it necessary to secure increased accommodation, and by October had about doubled my capacity.

I am now fully employed, with prospect of plenty of work for the next year or two.

I have not noted any special changes in the price of labor or materials.

Valley Machine Company, Saginaw, E. S., Mich., write us:

Business has been fair all season, but this month is banner of them all. We have sold more key-seating machines than we can deliver in sixty days. Collections have been very slow. We have increased our capacity some this year, and expect to more next, as our business demands.

Buffalo Forge Co. (Manufacturers of Forges, Blowers, Exhausters, Punches, Shears and Drilling Machines, Patent Steam Hot Blast Heaters, Ventilating Wheels and Engines), Buffalo, N. Y., write us:

The year just closing has shown a steady and healthy growth, and a great increase in the sales of machines in all lines; notwithstanding the increased competition in the department of forges, the popularity of "Buffalo" makes it steadily on the gain. This is best indicated by the fact that sales this year exceed those of any previous year's business by several thousand. The number of machines sold in all lines of our manufacture show an increase over any previous year. The line of "Buffalo" goods is forges—portable, stationary and heating, hand blowers, blacksmith drills—power and hand, punch, shear and bar cutters, shaving exhaust fans—single and double, cupola or steel pressure blowers, countershafts, blast gates, "B" or volume blowers and exhaust fans, disk wheels with pulley, direct attached engine and electric motors, "hot blast" lumber and brick dry kilns, "hot blast" heating and ventilating apparatus, steel plate steam pulley fans for all uses, horizontal and vertical engines. In the department of "hot blast" heating and ventilating we are exceedingly busy, the department being crowded to its utmost capacity to execute orders.

Special note should be made of the increased use made of steel plate blowers. For different purposes they are built of various dimensions; some adapted to deliver air at a high pressure, others designed for a larger volume at less pressure. Special engines are also used, both vertical and horizontal single and vertical and horizontal double, in each of the types. This type of fan is being largely used for forced draught service, not only under steamboat boilers, but for electric light stations and large power plants generally.

We have recently brought out several new designs, with which your readers will become familiar later. Many large foundries are now purchasing blowers with engines on the same bed-plate, these usually being of the double vertical type. Increased orders have demanded extra foundry capacity, and the arranging of a large testing room for "fan" work; this being of sufficient proportion that very large machines may be run continuously; for example, recently a fan for my ventilation, exceeding 20' in diameter over all, was easily accommodated in this room.

Necessarily increased facilities call for the latest improved machinery. This is being added from time to time, as required; quite an outlay has been placed in this direction since the last report.

John L. Kelley (Kelley's Automatic Stop Governor, Kelley's Automatic Steam Flue Cleaners, etc.), Erie, Pa., writes us:

I am satisfied that I have received a fair share of the business done in my line of specialties. The sales of my flue cleaners are increasing every year. I received one order in July last for 1,000 adjustable steel flue scrapers, 150 of my automatic double blower steam flue cleaners, and the many orders I receive from unknown parties, without previous inquiry as to price is very flattering, and illustrates how a good thing will sell when its merits are known. The tendency of prices has been downward, and to meet this I have designed and built a number of special tools.

The prospects of business for '92 are fully as good as they were a year ago with me. I shall add several new specialties to my line the next year. Inquiries are numerous and trade is good at the present time.

American Standard Gauge and Tool Works, Wilmington, Del., write us:

Our business for the year 1891 has been satisfactory. The demand for our tools has increased, both in this country and in Europe. Inquiries have been largely in excess of any past year. The outlook for the new year is fair at the present time.

Many letters stand over, to appear in a future issue.

LETTERS FROM PRACTICAL MEN.

Boring Rigs.

Editor American Machinist.

I send you herewith attached a general outline of some boring devices which have proved of value. I do not recollect of having seen them published; perhaps they may be of service. No. 1 shows a cast-iron holder with hinge lid attached in position of compound rest, a large variety of small boxes, bearings, bushings, etc., may be readily held for boring. It will, of course, be understood that work of smaller diameter than the hole in holder will require to be held in a form fitting in holder. Wherever possible two cutters should be placed in the boring bar at proper intervals—one for roughing, the other to finish.

No. 2 represents two holding rings bolted to lathe carriage, with work held centrally by means of set-screws projecting through and binding the work for holding long, awkward castings; this rig is especially serviceable—long bushings, rocker boxes, and small cylinders may be set quickly and bored correctly.

No. 3 is a convenient method of boring driving boxes in use at the Union Pacific shops, in place of the boring bar, as shown; they are using a long head screwed on the spindle, with an adjustable tool attached in front. While the results are good, I have an idea that too much strain is put upon the head journal and spindle of machine; the pressure must be considerable, the tool being so far advanced from its support. I have always considered it a wise plan to assist both ends of a bar in boring wherever possible, and as the machine allows an outer support, show it in use. L. C. SHARP.

U. P. Ry. Shops, Omaha, Neb.

An Interesting Experiment With Steel.

Editor American Machinist:

In the AMERICAN MACHINIST of the 17th of December I notice a criticism (about steel) of my letter, An Interesting Experiment with Steel), which appeared in your paper on the 12th of November, and would like to make reply, which will be as brief as possible.

The critic in question misunderstands my letter so well that it looks much as though it gave him pleasure to do so.

The real characters of my word picture are left untouched, while some filling in material, whose only purpose was to be a setting for the principal work, is attacked with thumb rules and the like.

1st. My critic tries to do some hasty trimming before I have the walls up.

2d. I said *about* 2 per cent. of carbon, and *about* 98 per cent. of iron; in the sense in which I use the word (*about*) 2 per cent. of carbon may mean $\frac{1}{8}$ of 1 per cent. or 5 per cent. I mentioned percentages simply to show the difference between the two, and not as a rule of thumb for steel workers to be guided by.

3d. As to the various treatments of different irons and steels to produce certain effects, this matter cannot be put in a nutshell, but for the present I will say there is more carbon in what appears to be almost carbonless iron and steel than is commonly supposed.

4th. The particles I mention are invisible under the most powerful microscope; the particles he speaks of can be seen without spectacles. My friend has evidently jumped the track to chase a jack rabbit across the prairie. While doing so, he has turned about, and looking backward, imagines I am behind. CHARLES WETTERER.

The Lighting of Paris, France.

Editor American Machinist:

Bonger has found that the sun at noon yields a light equivalent to that of 70,000 candles placed at a distance of one meter (= 39⅜ inches). Great differences, of course, exist in the manifestation of this lighting power. On the ground floors of houses in streets it often does not exceed 50 candles power, while in the upper stories of houses well situated it reaches 200 candles.

M. Hyp. Fontaine has estimated that the average sunlight for all portions of the city of Paris (streets, squares, houses, etc.,) is equal to about the light of 800 candles at a distance of one meter, during a daily period of 12 hours.

A light equivalent to that of one candle at a distance of one meter may be obtained over a given area by the use of as many candles as there are square meters in the surface in question. The area of Paris is 78,000,000 square meters. The quantity of solar light spread over the city is calculated, therefore, to be equivalent to that of 116 millions of candles for each inhabitant per year.

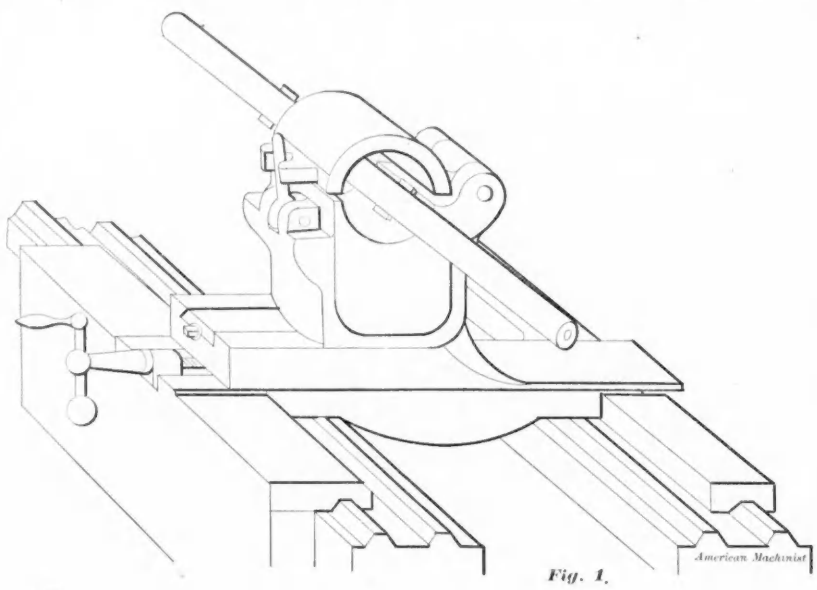


Fig. 1.

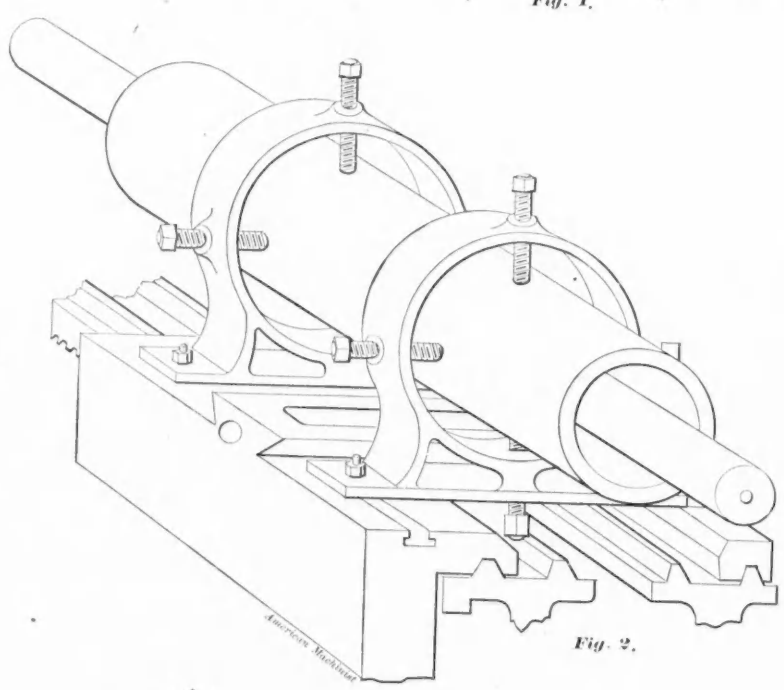


Fig. 2.

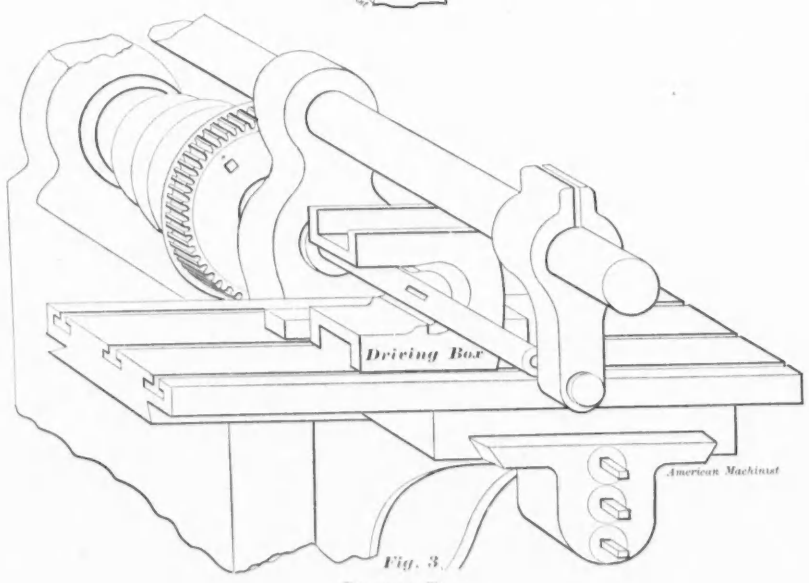


Fig. 3.

BORING RIGS.

The progress made in electric lighting may be gathered from these figures, as in the course of a few years it has become the second chief source of light. This, however, causes no anxiety, as the light procured from mineral oils and from coal gas has also largely increased of late, the decrease being alone in the case of candles and vegetable oils. The large amount of light obtained by electricity is in a great measure due to the demand for it for the lighting of streets, public buildings, large stores, etc., and it is by no means distributed proportionately amongst the inhabitants. So long as these retain their present method of lighting their apartments the supply of gas light and mineral oil light will continue to increase in proportion to the growth of the population, electric lighting being still too costly and too much of a luxury to permit of its general adoption in private dwellings. All the light-giving appliances are therefore still a long way from turning the night in our cities into day. The problem of supplying electric light to the dwellings of the masses at a reasonable price also still awaits solution. WM. COX.

This is more than 10,000 times as much as the artificial light supplied to the city from all sources. This latter is estimated by Mr. Fontaine to have been for the year 1889 equal to 11,300 candles per inhabitant, or about 30 candles per inhabitant per hour. He divides the sources of this artificial light into the following:

From wax and tallow candles	190
From vegetable oils	517
From mineral oils	1,995
From coal gas	6,470
From electricity	2,130

—being a total light equivalent to 11,302 candles per inhabitant per year.

Rules Outweighed by a Life.

"It isn't often that an operator stops to think of the message he receives or sends," said an old operator. "They are all of a size to him. But I remember one time during the late war I felt my eyes moisten as I read the following to Senator Fessenden:

"'My son is sentenced to be shot to-morrow morning at six, for sleeping at his post. Will you kindly see President Lincoln at once, and intercede till I can reach Washington to present evidence which will clearly prove my son's innocence?'

"I knew that if the message was compelled to wait its turn it would not reach Senator Fessenden till too late for any hope of reaching the President, to say nothing of getting a reprieve sent to the line of battle where the son was. I said to myself, 'Here is a human life hanging by a thread. Shall I cut the thread by letting the message take its turn?' No, I couldn't. I violated the rules and telegraphed the solemn message to all the hotels in Washington till the Senator was found and the message safe in his hands. Word came back that Senator Fessenden had obtained the reprieve, and I telegraphed the glad news to the poor old man up in Maine."—*Detroit Free Press.*

Later particulars of the recent terrible railroad accident on the Orel-Griasi line in Russia show that the disaster was one of the most complete of its kind on record. The train, which was a long one made up of passenger carriages and freight trucks, was on the way from Orel to Griasi, when one carriage ran off the line, owing to the breaking of a tire. The train was traveling very fast at the time, and the carriage was dragged along with the rest, plowing up the permanent way and plunging from side to side. A few moments later the train reached the river Optukha, and as it was crossing the bridge the carriage at length overturned, and, falling against the parapet, which broke down under the shock, was precipitated into the frozen river. Four more carriages were dragged down with it, and then the breaking of the couplings saved the rest of the train. The weight of the falling carriages broke through the ice with which the river was thickly covered, and four of them disappeared beneath the frozen surface. The fifth fell on the top of the others, and, turning over, remained supported on the wreckage, being only partly submerged. It was from this carriage alone that any persons were recovered alive. The total number of the passengers who were drowned was still uncertain at latest reports, but must have been something appalling.—*Evening Post.*

Inventor—"Oh, the fatality of things. Here I have an invulnerable, non-atmospheric, spectacular, refractive, non-reverberating, non-oscillatory watch, perfect in detail and mechanism; and yet I am almost starving."

Friend—"Why don't you sell the patent?"

Inventor—"The fools won't buy it, just because it won't keep time."—*Jeweler's Circular.*

The Chicago & Alton, on and after Jan. 1, will discontinue the use of unlimited tickets. It will also abolish the stop-over privilege, and compel passengers to buy tickets as they travel. The one-way tickets will be limited to one day after date of sale, and the round-trip tickets will have a similar limit on the "going" coupon, with a ten-days' limit on the return coupon. The company will redeem unused tickets at full value.

The convention of electrical linemen, that recently met at St. Louis, has formed a national organization, and will apply for a charter, and send a delegate to the meeting of the American Federation of Labor, at Birmingham, Ala.

To Mold a Steam Cylinder in Dry Sand.

BY S. BOLLAND.

In order to make the subject of dry sand molding intelligible to those who are not conversant with this branch of the trade, it will be necessary to take a few leading jobs, choosing such as will bring out, in detail, the leading principles involved in the production of all such work.

The chief object aimed at by this mode of procedure is not the mere description of how such a job is made, but rather to inculcate such principles in the mind of the reader as will enable him not only to apply them, when learned, to other jobs, but will also help him to think for himself as to how he might accomplish the same end by means perhaps widely different, but equally safe.

Fig. 2 is a horizontal section, Fig. 3 side elevation, Fig. 4 cross-section, and Fig. 5 front elevation of the cylinder we propose to mold. Its chief dimensions are 30 inches diameter and 6 feet long.

It will be seen that the exhaust is placed at *A*, Fig. 4, and that the cylinder is intended to be secured to its foundation by the bearers, or feet, *B* and *C*, which extend the whole length of the cylinder.

We first determine that it shall be cast on end, with a "head," or extension, cast on the top end, to receive the sullage which always gathers in the mold as the metal is poured in. A careful inspection of Figs. 1 and 6 will enable the reader to see the whole plan of operations required to bring the mold to this advanced condition.

Contrary to the generally adopted method of molding cylinders on the side, I have, for special reasons, preferred to show how to mold this one with the steam chest down and both bearers in the cope. This, as will be seen, necessitates the use of a three-part flask, as shown at *B*, *C*, *D*, Figs. 1 and 6.

Should it be thought desirable to carry all the sand in the cheek by the use of bars, as seen at Fig. 7, then there would be no need for the lifting plate *E*, but the latter will be found a very useful adjunct to the rig, and saves considerable expense and time when it can be substituted for the bars spoken of.

The manner of ramming cheek and bottom flask when the plate *E* is used is to set the bottom half of pattern on a faceboard with the steam chest up, place the cheek over and proceed to ram, securing all overhanging sand, as indicated by *F* and *G*, by the insertion of irons reaching from the box inwards, as shown. All such parts as exhaust branches, stuffing boxes, etc., can be more easily rammed and secured by using the plate in this case, but the bars, Fig. 7, will be found to be indispensable in many other jobs.

In making plate *E* it will be seen that it allows for the parting to be made at the upper edge of the steam chest flange. This places all of the flange at the bottom flask. This will be found an important feature when setting in the steam chest core.

When the cheek is rammed and the plate firmly bedded down on the sand and bolted to the cheek, as seen at *E*, Fig. 1, it will be seen that the only portion of parting which requires to be made is from the edge of the plate to the edge of flange, after which the bottom flask is placed and secured, as shown at *E*, *E*, Fig. 1, and the ramming completed.

After rolling over the two lower boxes and making good the joint, set in position the two arbors *H* and *H*, which are made to carry that portion of sand between the joint and the under side of bearers *I* and *I*, Fig. 1.

By referring to Figs. 8 and 9, it will be seen that these arbors are made so as to rest on the ends some distance past the flange of cylinder in both instances. Fig. 8 shows one end of pattern and sectional elevation of arbor set in position, and Fig. 9 is plan of the same. As will be seen, provision for lifting with the cope, and separating when the latter is lifted off, is made by casting a nut in each end.

The points of separation are made at the ends by the slanting bar *A*, Fig. 8, and along the back, as seen at *H* and *H*, Fig. 1.

I am aware that a block print and core will accomplish all that the arbor does for this job, and is to be preferred in some instances, but I deem it well to introduce the arbor here, as it will be found to be a very useful device in general practice.

In making patterns for such a job as this, it will be found best to have the two halves of the body separate from the rest of the pattern, bearers in cope, steam chest, and all other appendages being secured to them by screws from the inside.

As will be seen at *F*, Fig. 6, the lower end of cope and cheek are made closed edges, whilst the head end *G*, Fig. 6, is made open, to allow of the body core passing through a distance sufficient to form the runner basin around it, the gates being cut direct from the outer edge, as shown at *G*—the larger one, seen at *G G*, being the riser.

The practice of cutting a main runner around the upper core seat, through which the iron passes from one large leader, and from thence into the casting at intervals all round, is not a good one, as it is more than likely that most of the iron, if not all of it, is absorbed by those nearest the leader, the dirt, of course, following in its wake.

It is to obviate this bad feature of running that the method shown at Fig. 6 is advocated, because it allows of the main runner being made all round the core and entering the mold at as many places as possible, always taking care to miss such cores as stand through to the body, and thus assuring a thorough breaking up of the scum as it rises during the process of pouring.

How to make the body core, as shown in Fig. 6, is fully explained in article on core making, AMERICAN MACHINIST, January 9, 1890. One special feature in these barrels, however, is that the lower end of barrel may be made so as to close in the end by having a solid plate on that end, the top to be the same as shown at Fig. 19 of the article quoted. The object aimed at by this device is to secure absolute safety by making it impossible for any of the molten iron to find its way to the inside of the barrel.

To secure the lower end in all other respects, it is shown that the seating is cut clear to the box end, as seen at *H*, Fig. 6. When closing, the body core is kept back from the box, to allow of a ramming of sand behind, which ramming is continued after the cope is closed over through the space *J*, which is left open for this purpose.

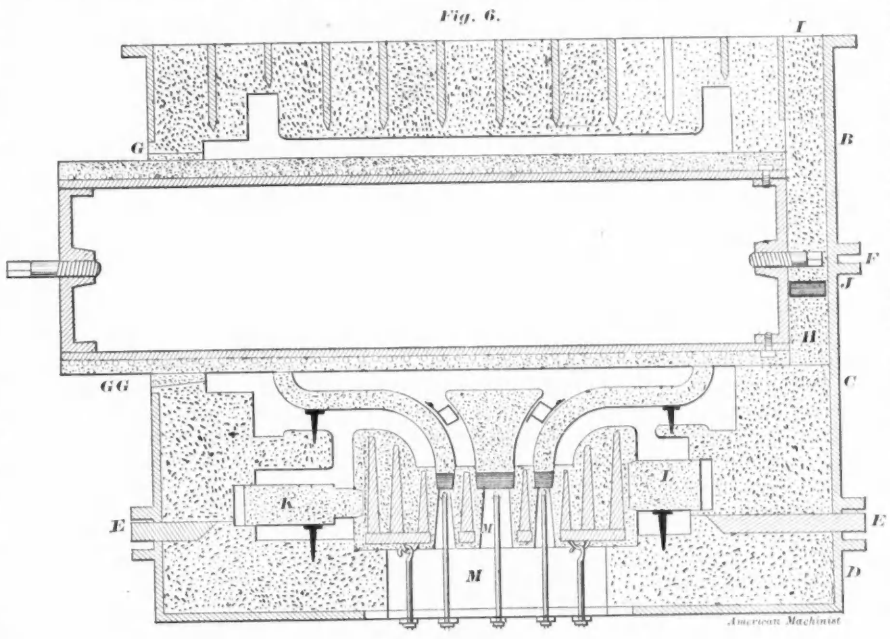
To prevent the barrel from slipping when the mold is turned on end, the packings shown at *J* are inserted.

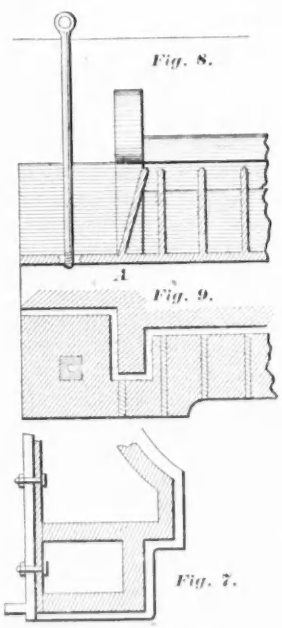
In making the bottom flask *D*, the bars must be arranged after the manner shown at Fig. 10, the central space to be as wide as possible, so that easy access may be had to all the vents and staples connected with the cores.

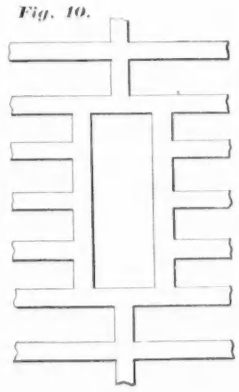
At *J*, Fig. 1, is shown a space dug out, to allow of the exhaust flange being withdrawn. This, of course, is the only way of reaching this flange when the exhaust branch is made after this manner, and can only be dispensed with by the use of block cores, either rammed against the pattern or inserted into suitable bearings after the withdrawal of the pattern; both of which modes are objectionable, on account of the seam produced at the junction of the mold and core. When it is practicable, as in this case, the method herein described is the best.

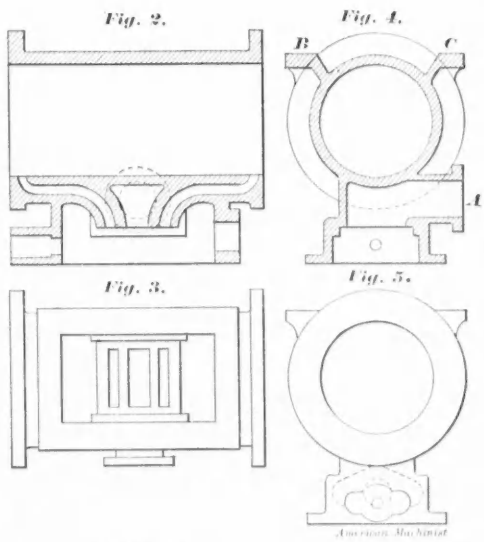
The space *J* is to be packed with sand after the core cake *K* and exhaust core *L* have been permanently fixed in their true positions.

Cores *K* and *L*, Fig. 6, are to be kept in the spaces shown behind them until the cheek is closed over the steam chest core, when they can be drawn forth into the seatings prepared for them in the chest core, as seen; and, as these cores must be held in position by packing in sand behind them, provision must be made for that purpose, either by having holes in the end of the flasks or by cutting down to them from the joint at the most convenient place.









TO MOLD A STEAM CYLINDER IN DRY SAND.

Firearms of Early Settlers.

The precise population of New England, either Indian or white, at the time of Philip's war cannot be stated, but for the purpose of war it may be said that the forces on one side and on the other were equal. At that time the Indians were as well used to firearms as the whites, but the firelock of those days was but an inefficient weapon compared with the musket of later times or with the rifle of to-day.

It seems certain that in Europe flintlocks had been introduced before this time; but, on the whole, the concurrence of evidence shows that such locks were not used in the civil war in England, and that both the king's party and the Puritans still relied on the matchlock. The form of this can be readily explained to any person who has seen the old flintlock of the present century. A hammer—a good deal larger than the hammer which afterward held the flint, but quite like it—had a screw which tightened or loosened the hold which two pieces of iron had upon a match.

Each soldier was obliged to carry some yards of this match with him, and when the battle began he lighted the piece of this match which was fixed in the hammer of the gun. A pan which held powder, exactly as the pan of a flintlock afterward did, was in front of the hammer, with a cover projecting, from which a sort of a horn ran up nearly vertical, to be opened by the hammer when the soldier pulled the trigger. The fire of the match communicated with the powder, and the gun went off.

This was a sufficiently complicated way in which men should go to battle, perhaps, in a wilderness, where even the procuring of fire at that time was attended with some difficulty. The accounts of skirmishes of those times are full of occasions when a shower put a stop to the whole battle. This is because the fire of the matches was extinguished by the rain.

To change this rather clumsy lock into a flintlock simply required that a flint of sufficient size should be screwed into the hammer in the place made for the match. The flint, then striking upon the cover of the pan, made a spark which fell at the moment the pan opened into the powder. Eventually these locks were made with great precision, so that the gun missed fire very seldom.

I have no doubt that one and another soldier in Philip's war found for himself that a flint Indian arrowhead screwed in the place of his match could be made to answer the purpose of firing the powder much more readily than the match itself could do. A similar invention, however, as I have said, had already been made in Europe, so that it is thought that flintlock guns had been found in France as early as 1640. In 1672, however, just before the war with Philip began, the law of Massachusetts and the provision made for her soldiers still required the use of the matchlock.—*The Chautauquan.*

The labor statistics of Colorado show that 19,624 persons are employed in the industries of that State who last year earned $12,951,763.55, or an average of about $2 per day, which is a very good showing as compared with the average in eastern States. The majority of the female wage workers earn less than $11 per week. The aggregate value of the manufactured product was $70,027,854.50.

Ground has been broken in both New York and New Jersey for the construction of the New York and New Jersey Bridge, which is to span the Hudson River.

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F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

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NEW YORK, JANUARY 7, 1892

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Business Prospects for 1892.

As has been our custom for some years, we invited, at the beginning of this year, leading manufacturers in the lines of trade which we represent to speak for themselves as to the past year's business and the prospect of business for the coming year. Following this plan, we present this week a large number of letters, our space compelling the leaving to another issue the presentation of many of them. Such as we are able to present in this issue will show very clearly the general drift of trade matters, and will be of interest alike to employers and employes. We bespeak for them the careful consideration of every man engaged in the industrial crusade, which includes all countries. These letters are fresh from the manufacturers, and they can be taken not only as showing the facts as to their business last year, but as showing their opinions as to the prospects for next year.

The letters speak for themselves, and any extended comment upon them is unnecessary.

The Latest Slaughter.

Last week we had something to say regarding the collisions on the New York Central road, our remarks being called out by an accident in which only the enginemen lost their lives. This accident did not attract much attention from the press generally, because no passengers were killed, but scarcely was the ink dry upon the paper when another collision took place on the same road, in which twelve passengers were killed, and now every paper in the land is commenting upon it and upon the management of the road, some with more or less intelligent knowledge of what they are talking about, but far more in palpable ignorance of about everything pertaining to railroads.

There is little to be said regarding this latest accident which does not equally apply to the other and it is simply outrageous that a road so well able to have the best equipment, which is running so many trains and at such high speeds, should be so managed that such collisions are possible. The means for almost if not quite absolutely preventing them have been in use on other roads for years, and the excuse given by one of the N. Y. C. officials, that the company had not put in such a system because it had been "waiting to determine what one was the best," is nothing more nor less than silly. There is abundant evidence, aside from this, that the management of the road utterly fails to appreciate its responsibilities—among others being the words of a newspaper owned and edited by a man who holds a son-in-lawship in the Vanderbilt family; these words being as follows: "There is nothing so reliable and effective as living, sentient human beings, and the road was amply supplied with them, as watchmen and guardsmen, well drilled in duty. But there is no force within the power of man to compel such living beings, skilled in special duty, to perform that duty, except themselves." This amounts to a declaration that the antiquated methods in use on the road are better than any of the newer systems which have proven their value on other roads, and is just such a sentiment as would be expected from the management of a road which is largely in the hands of men who either know nothing of practical railroading or are old fossils whom the world, in its progress, has left far behind. In this connection, attention is called to the fact that the Executive Committee of the Central Board of Directors does not include a single active practical operating officer, and its members are almost exclusively financial men—capitalists, whose only idea of running a railroad to make money is by doing spectacular things in the way of running fast trains and then cut down requisitions coming from the various heads of departments calling for things needed to safely and properly operate the road.

Railroad officials and their organs are wont to complain bitterly of the modern tendency upon the part of the public to demand the enactment of laws regulating the operation of railroads; but it can certainly be expected that such tendencies will increase so long as such flagrant neglect of duty is possible.

The public cannot make a choice of different roads when traveling to places reached by the Central, but must take its trains and accept such service and such protection as it may choose to furnish. There can in the matter of railroads be no free competition, as there is in the running of steamships, so that a man can, if he chooses, take the safest means of conveyance; but he must usually go by the only road that reaches his destination. And since these accidents which have happened, and others as well, show conclusively that railroad officials cannot be depended upon to do their plain duty in the matter of securing safety, the public has a right to step in and interfere, as it has done in the matter of car stoves, to compel the performance of duty.

The statement of rear brakeman Herrick, who let the St. Louis express go by him, when sent back to protect the rear of his train, has been published, and bears internal evidence of being a truthful one. And if true, it is plain that he did nothing different from what it was natural for him to do, and nothing more than would be liable to be done by a large majority of men under the same circumstances. Of course we all know that he should have remained on the track with his red light, and that the rules required him to do so. But he had what would be accepted in nine cases out of ten as positive knowledge that the next train to come over the road was a local that stopped at the station, and when it stopped he expected to go outside and notify the engineer of the train standing ahead. He did not know that the local had been taken off, and that the next train was the St. Louis express, until it went flying past the station. Of course it is easy to say that his sole duty was to stay on the track until called in by the engineer; but there are hundreds of examples to show that human nature is such that men will risk action on what they have good reason to believe to be the facts of the case. Herrick thought he knew that the next train would stop at the station, and his action, though culpable, was natural. It may be depended upon that so long as the rear brakeman with his flag or lantern is depended upon to protect the rear of trains, such accidents will be repeated from similar causes. No rules of railroads or of any other power can improve human nature. If such roads as the New York Central will still depend upon the rear brakeman, and refuse to adopt improved safety devices, the law-making power should compel them to adopt them.

It has been stated, in connection with the wreck, that 98½ per cent. of the double track roads in England and Wales are protected by the absolute block system. It would seem as though the road that comes nearest being so protected, between this city and Chicago, by the opening of the Fair there, will get the bulk of the business; and it ought to do so. It is hard to believe that people who are used to traveling upon decently protected roads in their own country will choose to trust their lives to a road in this which is practically without protection.

The "Legitimate Demand" for Coal.

The matter-of-fact way in which coal men are accustomed to regard the operations of the coal monopolies is frequently shown by the journals devoted to the coal interests. We find in the *Coal Trade Journal*, for instance, an article condemning the mining companies for the reported mining of somewhat more coal than agreed upon by the combine, and it says finally: "This thing of digging coal at the rate of over 57,000,000 tons a year, when the legitimate demand is about 36,000,000, means trouble somewhere."

We suppose it does mean trouble somewhere, but the fact that there is a combine, which, in spite of occasional underhanded and dishonest breaches of its rules by its own members, can yet keep the price of coal to consumers far above what it should be and would be if the mining and transportation were open to free competition, causes a great deal of trouble to poor people who find it difficult to pay for any coal at the ruling prices, and to manufacturers as well, who are charged "all the traffic will bear" for their supplies of fuel.

And what does the *Coal Trade Journal* mean by talking so glibly of the "legitimate demand" for coal? What is the legitimate demand for coal? Does the *Coal Trade Journal* or any other journal or person know what the legitimate demand for coal is? It is perfectly safe to say that the vast majority of families in this country who use coal at all use less of it than is actually necessary to make their homes really comfortable, simply because they cannot afford to burn more of it. Who knows how much more coal would be burned as the result of a substantial lowering of its price? Is the "legitimate demand" to be taken as that amount of coal which the people can just manage to pay for at the highest prices which can be maintained by illegal combinations, or should it be estimated upon the basis of what would be consumed under natural conditions? And if the latter, then who knows what the "legitimate demand" for coal is?

There is talk now of strengthening the coal combine by forming the different companies into one large company, to be under a single central management. This would enable prices to be made somewhat higher and the amount of coal burned per capita somewhat lower probably. Would we then be regaled with information about the "legitimate demand" for coal? On some accounts it would be a good thing if the closer combination talked of could be arranged, for the sooner these things get to the unendurable stage the sooner the people will realize that they have rights in the matter. And when they do realize this some laws will be enacted and put in force that will be very apt to put things on a different basis.

Literary Notes.

ELECTRICITY FOR ENGINEERS. A Clear and Comprehensive Treatise on the Principles, Construction and Operation of Dynamos, Motors, Lamps, Indicators and Measuring Instruments; also a full explanation of the electrical terms used in the Work. Revised Edition. By Charles Desmond.

This work has been written for engineers who have charge of electrical plants, and contains information that many engineers are looking for. The character of the work is thoroughly practical, the different subjects are presented in a plain manner, so as to form a comprehensive treatise on the principles, construction and operation of dynamos, motors, lamps and electrical instruments, including many practical kinks as met with in the author's practical experience. Practical men who wish to become familiar with these subjects cannot do better than to procure a copy. It is published by Frederick Keppy, Scientific Book Publisher, Bridgeport, Conn. Price, $2.50.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(1) G. A. M., Palatka, Fla., writes: Kindly favor me with some data that will be useful to enable me to design a gas engine. I would like to know how much air and gas is used for an explosive mixture? When the explosion occurs how much pressure is exerted per square inch? *A.*—To answer your questions as they should be will take up too much space in these columns. We therefore refer you to the work treating on the Gas Engine, by Dugald Clerk, published by John Wiley & Sons, New York.

(2) J. P. P., Middletown, Conn., writes: Can you tell me with what kind of tools and how lava is turned? *A.*—We should use the ordinary tools made of good steel and well hardened, such as are used in lathe work. Experience will soon indicate the

best form to give to these tools, and the attachments required on a lathe for any special kind of work in lava. 2. Can you refer me to any good articles in the AMERICAN MACHINIST in which the operations of cutting spiral gearing and laying out the cutters for that purpose are described? *A.*—See our issues of July 31 and August 7, 1890.

(3) A. B., ——, Mass., writes: A steam engine running at the rate of 250 revolutions per minute has a fly wheel with a face turned like a pulley, 42 inches diameter. The line shaft is to make the same number of revolutions, and consequently it has also a pulley 42 inches in diameter. A double belt four inches wide will carry all the power the engine develops. My friend says that with a 24-inch pulley beside the fly wheel and a 24-inch pulley on the line shaft, and a 7-inch double belt, the engine will run steadier, and the results will be more satisfactory all around. But he cannot explain why. Please give your opinion. *A.*—We prefer the large pulleys, although it is possible that, under some conditions, the engine will run steadier with the smaller pulleys.

(4) L. C. W., Scottdale, Pa., writes: Please give me a formula for finding the circumference of an ellipse whose minor and major axes are given. For example, what is the circumference of an ellipse whose major axis is 12 inches, and the minor axis 9 inches? *A.*—The following formula, taken from Trautwine's Civil Engineers' Pocket-book, will give good results:

$$\text{Circum.} = 3{,}1416\,d + 2\,(D-d) - \frac{d\,(D-d)}{(D+d)\times(D+2\,d)}$$

in which D denotes the major axis, and d the minor axis. Substituting for the symbols their values as given in the example we have:

$$(3.1416\times 9) + 2\times(12-9) - \frac{9\,(12-9)}{\sqrt{(12+9)\times(12+18)}}$$

which reduces to

$$28.2744 + 6 - \frac{27}{\sqrt{630}}$$

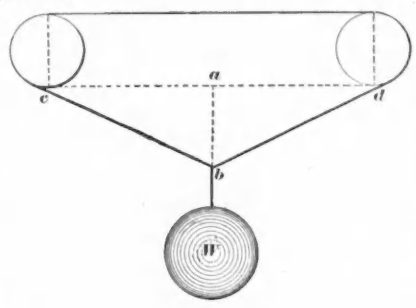
hence the circumference is equal to 34.2744 — 1.075 = 32.1994 inches.

(5) S. T. W., Baltimore, Md., asks: What do you consider to be the best size for a blue print frame, and the best size of blue prints for shop work? We are thinking of making a frame 3x5 feet. *A.*—We see no objection to this size of frame. We should first establish standard sizes of sheets on which the drawings or blue prints are to be made, and then make the frame to take in the largest sheet. For ordinary detail work we prefer sheets about 15x10; if some work requires larger sheets we should make the next size 15x20 inches; but we should use the smaller size whenever it is possible to do so, as drawings of this size are very convenient, and do not take up much room near a workman who has to refer to them. For general plans larger sheets are required; their size will depend much on the character of the work on which you are engaged, but they should all be drawn on the same size of sheet, and the blue print frame should be large enough to take in these general plans. 2. Some makers make their lathes with the forward feed handle of the carriage to be operated by the right hand; other makers make theirs to be operated by the left hand. Which do you consider right? *A.*—In small and medium size lathes we prefer to work the feed handle of the carriage by the left hand; in large lathes, by the right hand.

(6) C. E. D., Springfield, Ohio, writes: In order to decide a dispute, please say which is right. A friend of mine said that a body falling freely will fall through a distance of $16\frac{1}{2}$ feet, and its velocity will be $32\frac{1}{6}$ feet at the end of a second. I say that a body falling freely in air, and not taking into consideration the resistance due to the air, will fall through a distance of 16.1 feet, and its acceleration at the end of the second will be 32.2 feet, and the one that I use is the one which is generally used, and that neither one is absolutely correct. *A.*—It has been found by experiment that the velocity imparted to a body in one second of time by the action of the force of gravity in the latitude of New York is about $32\frac{1}{6}$ feet, or we may say that its acceleration is $32\frac{1}{6}$ feet per second. According to the laws of falling bodies, the space described in a given time is equal to one-half the product of the acceleration per second into the square of the time in seconds. This may be expressed in symbols:

$$s = \tfrac{1}{2}\,g\,t^2,$$

in which s denotes the space in feet fallen through, g the acceleration per second, and t the time in seconds. Hence during the first second the body, starting from rest, will fall through a space of $16\frac{1}{2}$ feet. In discussing the laws of falling bodies it is found convenient to regard them as being situated in vacuum, so that the laws will apply to all bodies of any weight. The acceleration of $32\frac{1}{6}$ feet per second is adopted in nearly all text-books; but, for convenience in making approximations, 32.2 is generally adopted, which for many practical purposes is sufficiently close. Although we cannot say that your statement is all wrong, it is but just to say your friend is nearer right than you are.



(7) E. F. G., Cincinnati, Ohio, writes: If two sheaves be placed 200 feet apart, and an endless wire rope be placed around them (like a belt over two pulleys), and a 1,000-pound weight be hung to one strand at one sheave, which is then put in motion and the weight transferred to the other sheave, then, first, what will be the stress produced in the rope when the weight is held stationary at the center, the sag being 10 feet? Second, what will be the strain in the rope when the weight is moving? These questions arise by the writer having invented a portable, adjustable cable hoist for steamboats to use in unloading, and noticing that all cable tramways for heavy weights have a main carrying cable stationary, while for light weights the moving cable is also the carrying cable. Why the difference? *A.*—First find the length of the line $c\,b$. To do so assume a horizontal line $c\,d$ drawn tangent to the pulleys, and through a the center of the distance between the two pulleys draw a vertical line $a\,b$, and make it equal to the sag; for the sake of simplicity we shall assume that $c\ b$ intersects $c\ a$ in a vertical line through the center of the pulley. The length of the line $c\,b$ is now found by adding the square of $c\ a$ to the square of $a\,b$, and extracting the square root from the sum. The line $c\ a$ = 100 feet; $a\ b$ = 10 feet; hence we have:

$$c\,b = \sqrt{100^2 + 10^2} = 100.49 \text{ feet.}$$

Let $a\,b$ represent the sum of the weight W and one-half of the weight of the rope $c\,b\,d$; the latter we shall assume to be 100 pounds, hence the line $a\ b$ will represent 1,100 pounds. Now the stress in the $c\ b$ will be as much greater than 1,100 pounds as $c\,b$ is longer than $a\ b$. Consequently the stress in $c\ b$ can be found by the following rule of simple proportion:

10 feet : 100 49 feet : : 1,100 pounds : stress in $c\,b$,

from which we get:

$$\frac{100.49\times 1{,}100}{10} = 11{,}053.9 \text{ pounds}$$

for the stress in $c\ b$. This applies only to a stationary weight. If this weight is fastened to the rope, and wheels set in motion so as to pull the weight W from one wheel towards the other, then the stress in the rope will be increased due to the pull, and consequently the diameter of the rope will have to be increased. But ropes of large diameter require wheels of corresponding large diameter, which may become so large as to be inconvenient for use, hence for heavy weights it is best to have a cable for carrying the load, and another for hauling.

(8) G. B., Brooklyn, N. Y., writes: Fig. 1 represents a cast-iron shell 12 inches inside diameter; the metal is $\frac{1}{2}$ inch thick. What weight on a step $1\frac{1}{2}$ diameter will break the head. Give formula. *A.*—The breaking weight can be computed by the following formula:

$$P = \frac{75{,}000\times t^3}{4}$$

in which P denotes the breaking weight in pounds, and t the thickness in inches. The divisor 4 varies with ratio of radius of step and cylinder head. Let r be the radius of step, and R the radius of head. Then when

$\frac{R}{r}$ =	10	20	30	40	50
use	4.07	5.00	5.33	5.92	6.22

in place of 4. According to the above formula the breaking weight will be

$$\frac{75{,}000\times .25}{4} = 4{,}687 \text{ pounds.}$$

This result should be taken as an approximation only. 2. When a cross-section at a in the center of a cast-iron beam shown in Fig. 2 has been decided upon, what must be the cross-section at $b\ b$ to sustain the same load with safety? The distance between the supports is 4 feet; cross section at a is shown in Fig. 3; what must be the cross-section at b, keeping the same breadth of flange throughout, but no web at the ends? *A.*—The first step will be to compute the load which the beam can bear. Let W equal the load in pounds at the center, S the unit stress on the fiber most remote from the neutral surface, I the moment of inertia, c the distance in inches from the remotest part of the cross-section to a horizontal axis passing through the center of gravity of that cross-section; and l the length in inches between the supports. The weight W is computed by the following formula:

$$W = 4\times\frac{S\times I}{l\times c}.$$

The remost part of the cross-section from the neutral axis is the bottom of web, and the stress in this part should be say 6,000 pounds per square inch; hence the value of S will be 6,000; the value of c will be 3 5 inches, and I, 9.5; l we know to be 48 inches Substituting for the symbols their values we have

$$W = 4\times\frac{6{,}000\times 9.5}{48\times 3.5} = 1{,}357 \text{ pounds.}$$

The load on each support will be

$$\frac{1{,}357}{2} = 678.5 \text{ pounds.}$$

Now the section at b should be large enough to resist a shearing force of 678.5 pounds. We should therefore make the flange of uniform thickness throughout, which will give ample strength at the ends. 3. What weight will 1 square inch of cast-iron, pro-

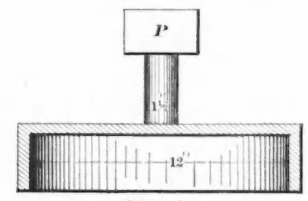


Fig. 1.

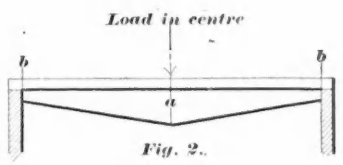


Fig. 2.

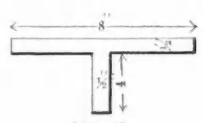


Fig. 3.

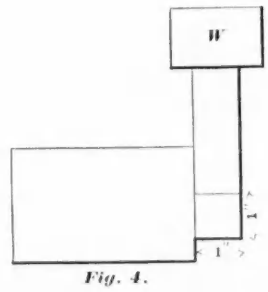


Fig. 4.

jecting 1 inch, as shown in Fig. 4, support? *A.*—We may assume this to be a cantilever loaded uniformly throughout. The weight W may be computed by the following formula:

$$W = 2\times\frac{S\times d_3}{6\times l},$$

in which S and l denote the same data as before, and d denotes the length in inches of one sideof the square. Substituting for the symbols their values we have

$$W = 2\times\frac{6{,}000\times 1^3}{6\times 1} = 2{,}000 \text{ pounds.}$$

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Ready-made cut Iron list gears. See page 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Gage Self-setting Planes.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

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Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Our Automatic Gear Cutting Machine will increase production 50%. The Superior Mach. Wks., Clev'd, O.

$13.00 I Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

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Save small iron from foundry refuse. It pays. Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

"Roper's Hand-books for Engineers and Firemen." Descriptive Catalogue mailed free to any address. Edw. Meeks, Pub., 1012 Walnut St., Phila., Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th St., N.Y. Send for des'n.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

For Sale—Several very good second-hand planers of medium sizes, first-class order and prices low. W. P. Davis, Rochester, N. Y.

N. Y. City Bolt & Nut Co., Limited, 33 and 35 Desbrosses St., N. Y. City, manufacturers of Machine Bolts of every description. Write for estimates.

Planer Chucks and 13" Upright Drills. For cuts and price address G. W. Jordan, No. 4 Wayne Street, Worcester, Mass.

25", 32", 37", 42' — "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Complete treatise on Screws and Screw-making, with clear and concise explanation of the methods: 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt Street, New York.

"Hawkins' Maxims and Instructions for the Boiler-room." 10 Parts, 25 cents each. Catalogue free. Theo. Audel & Co., Pubs., 91 Liberty St., N. Y.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Standard Measurements in Machine Construction.*

Continued.

BY FRED J. MILLER.

You see here (Fig. 1), a small bar of steel. It is one inch and a quarter long, and when I say it is one inch and a quarter long I do not mean that it is about or approximately that long, but I mean that the finest and most perfect appliances known to mechanics would fail to show that it varied from that length as much as $\frac{1}{50\,000}$ part of an inch, if at all. It is called a standard end measure piece, and the method followed in making it, though it produces the most wonderful results, is, in itself, quite simple, and consists mainly of operations performed by hand, as, indeed, you will find most operations are performed where the very highest and most accurate results possible are aimed at.

The piece, which is about $\frac{3}{8}$" square in cross-section, is first roughed out nearly to size and then hardened; after which two adjacent sides of it are ground straight and at

Fig. 1.

right angles to each other. These two sides are then placed in a V groove which is formed in a block in such a way that the piece is held upright, the block resting upon a plain plate in the center of which is a plug of copper charged with washed emery or diamond dust and oil. The block referred to is carefully made so that the end measure piece is held exactly perpendicular to its base. The end measure piece is then swept over the copper plug until one end is ground smooth and true, after which it is reversed and the other end ground in the same way. The ends, since they are each exactly perpendicular to the finished sides, are, of course, exactly parallel with each other. The length is frequently tested in the

* From a lecture delivered at the Young Men's Institute, New York City.

comparator as the grinding proceeds, care being exercised that when measurements are taken the temperature of the piece and that of the standard ruled bar previously referred to are the same. It will be noticed that I do not touch the end measure piece itself, but that it is handled by a small piece of wood which is inserted in a hole in the middle of its length, the object of this being to avoid heating the piece and thereby causing it to expand.

The best test of the extreme accuracy attained in this work is probably that described in the same report before referred to, as follows:

"The end measure pieces which your committee were shown at the works of the Pratt & Whitney Company were stated to be correct within $\frac{1}{50000}$ of an inch, and perhaps the severest practical test was made by laying a number of these pieces in a groove placed in a massive block of cast-iron, one piece being clamped down to form an end stop, and when the pieces laid down reached a length of twelve inches another piece was clamped down. A quarter-inch end measure was used as a try piece, and was held by a strip of wood inserted in a small hole passing through the piece; the end stops were adjusted until this try piece would just move easily, almost by its own weight. These pieces were then removed, and others which had been laid on the cast-iron block, so they might all have the same temperature, were substituted, care being taken not to disturb the end stops. Some twelve different sets were tried in this way, the same quarter-inch piece being used as a gauge, and these twelve sets were practically uniform in length, with one exception. In this case the quarter-inch piece was quite loose, and accordingly the end measure pieces composing this set were all carefully measured on the comparator as well as a set that had stood the test.

The difference in length between the two sets, one composed of nine pieces and the other of seven, was found to be less than $\frac{1}{100000}$ of an inch, and one piece of the set composed of seven was found to be $\frac{1}{200000}$ of an inch short, being exactly one-half the total error of the entire seven as compared with the standard bar, and this was found to be one that had been previously condemned on account of a defect in the end surface.

Dividing the total difference by the number of pieces in the set, the difference noted above, of $\frac{1}{100000}$ of an inch, between the total errors of the two sets referred to, shows an average difference for each piece of the first set, as compared with the length of the second set, of about $\frac{1}{75000}$ of an inch, and about $\frac{1}{125000}$ of an inch as compared with the subdivisions upon the standard bar, to which they were all referred."

It is thus seen that our faith in these extreme refinements of measurement is not based upon the unsupported declaration of any one man who might possibly be supposed to be interested in impressing others with an exaggerated idea of the possibilities of close measurement, or, as often happens in similar cases, be deceiving himself as a result of over-enthusiasm, but it is seen that commensurate results are obtained by men who, though not specially trained in the art of measuring, are trained in the art of making accurate observations of mechanical matters generally, and who are not in the least likely to be influenced by anything whatever except hard, cold facts as actually and unmistakably presented to their own senses. The report is signed by Mr. J. Sellers Bancroft, who is manager of the works of William Sellers & Co., a firm which was among the first in this country to realize the importance of standard measurements and interchangeable parts of machinery, and which has done much to bring about standard measurements; by Prof. Henry Morton, president of Stevens Institute of Technology; by Prof. S. W. Robinson, professor of Mechanical Engineering at the Ohio State University; by Mr. Oberlin Smith, who is at the head of a manufacturing concern in whose practice close measurements are an absolute necessity; by Mr. E. H. Parks, mechanical engineer for the Brown & Sharpe Mfg. Co., a firm which has been among the leaders in introducing standard gauges and measurements, and who have kindly loaned a number of specimens of their work in this line for our examination this evening; by Mr. Ambrose Swazey, of the firm of Warner & Swazey, who built the Lick telescope, which is generally acknowledged to be not only the largest telescope ever constructed, but by far the most precise and accurately constructed instrument of the kind in the world; by Mr. Chas. T. Porter, a very well known engineer; by Mr. Alfred Betts, president of the Betts Machine Co., and interested in the American Gauge and Tool Works, a business founded by Mr. John Richards years ago for the purpose of introducing standard gauges, and which is represented here by a number of specimens of work in that line, and finally by Mr. Geo. R. Stetson, who at

Fig. 2.

that time was superintendent of the shops of the Morse Twist Drill and Machine Co., an establishment in which exact measurements are of the utmost importance, and in which much attention is paid to them.

I refer to the character of this report and of its signers in this manner because it is of the utmost importance to know what our standard of measurement rests upon as a base, and what we have in the way of means of verifying our measurements, and knowing whether or not they vary from exactitude, and, if so, how much they vary. It affords me pleasure to be able to say that it is my belief, supported by what seems to be conclusive evidence, that in no other country in the world is the art of accurate measuring so highly and at the same time so generally developed as in this, our own country, especially in so far as this art takes the form of the making and employment of standard gauges for every-day use in shops, enabling machinery, and, in fact, almost all manufactured articles to be produced much better in quality and far cheaper in cost than they could possibly be produced without such gauges. Referring to this fact, Mr. John Richards, a gentleman exceptionally well qualified to deliver an opinion upon the subject, in a paper read before the Franklin Institute of Philadelphia in 1879, said: "The export of American-made machines to Europe commenced, we may claim, because of an early and successful application of the gauging system. One of the first and most important orders received from Europe for machinery was for a nearly complete equipment of implements for the Enfield small-arms factory in England; machines and tools, the main object of which was a duplication of their product. Watches, clocks, sewing machines, small arms, with many other articles of a similar kind, are now made in this country and sold in Europe, because the system of gauging and duplicating offers an advantage, overbalancing cheaper labor, cheaper material, and more than 3,000 miles of ocean carriage." This, as I said before, was written in 1879, nearly thirteen years ago, since which time we can say that exports of

Fig. 3.

American machinery and of the products of American machinery have steadily increased, and that the increase has been greatest in that class of fine machinery, and implements, the excellence as well as the economy of the production of which depends mainly upon standard gauges, the exact duplication of parts and consequent minute division of labor resulting from the use of standard gauges; and, finally, upon the high grade of skill and intelligence always necessarily found accompanying the use and full appreciation of such tools and methods of manufacture; for it is to be remarked that when the machines, tools, and methods of working needed for strictly maintaining standard sizes of parts of machines are fully developed, it is then found, usually, that these same machines, tools, and methods of working result also in the greatest economy of manufacture; in other words, the lowest possible cost of production.

All that has been said heretofore, however, relates simply to the relation which the actual sizes of parts of machines and tools bear to certain recognized standard bars. It does not necessarily follow from this that closer or more accurate work can be done in ordinary machine shop practice with standard gauges than without them. A plug and ring can be fitted to each other as accurately, if it is done without any regard whatever to a standard size, as if the size is made to conform to a standard; for, as a matter of fact, machinists and tool makers in ordinary good work, especially that which is made of hard steel ground or otherwise finished smooth and true, work within very small limits. I have shown you that a difference of diameter of .001" between a hard, round, smooth ring of steel and a plug of like finish and accuracy was easily perceptible; I will now show you that even a much smaller amount than this is easily perceived.

I have here one of the standard end measure test pieces before referred to, made by the Pratt & Whitney Co., tested by their Rogers-Bond comparator, and found to be precisely 1¼ inch in length. Here is a snap gauge (Fig. 2) made by the same concern and of the same size. As will be seen, the end measure piece fits the gauge nicely and is sustained by the friction between the highly polished surfaces, this friction being sufficient to even sustain the heavier mass of the gauge. Now this similar test piece is $\frac{2}{100000}$ (or $\frac{1}{50000}$) of an inch shorter, and, as you see, is not sustained by the friction, but freely drops out. Here is another test piece which is only $\frac{1}{100000}$ of

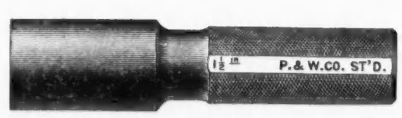

Fig. 4.

an inch less in length than the first one, and, as you see, it also drops out of the gauge, the contact not being sufficiently close to hold it. This means that a tool maker who wished to make two such pieces of precisely the same length would certainly get them so within a limit of variation of less than $\frac{1}{100000}$ part of an inch.

I have here (Fig. 3) a ring gauge 1¼" diameter. This plug is nominally of the same diameter, and, as you see, can be inserted by careful handling, provided always that the person handling it has had some previous practice with such gauges. It sticks, as was seen to be the case with the other similar gauge, and for the same reason. Now this plug is not .001" smaller, but one-twentieth of this, or $\frac{1}{2000}$ of an inch smaller; you will readily perceive that it is not so close a fit as the other plug, which is about one-fortieth the diameter of a hair larger, and upon applying the snap gauge to the plug a difference in diameter is readily detected. In other words, a good machinist or tool maker aiming simply to make these plugs of the same size, without any regard to a standard of measurement, would surely lap the larger one down a little, and in so doing would make the two plugs vary from each other less than $\frac{1}{2000}$ of an inch.

Corresponding results are obtained when the diameters of the plugs are tested in this measuring machine, or bench micrometer caliper (Fig. 5, Prof. Sweet's machine, made by the Syracuse Twist Drill Co.), the larger plug being quite perceptibly tighter than the smaller one, and when the screw is moved to make them equally tight as near as possible the difference of the reading of the scale is by estimation just equal to their actual variation from each other.

But the ability to distinguish a very small difference in diameter between two plugs, and to eliminate that difference, is an altogether different thing from being able to ascertain what that variation is in terms of an inch or other standard, and for doing this we must have a means of knowing just what an inch is, and it is highly important that an inch or any division of it shall mean the same thing when measured by the same workman at different times, or by different workmen in the same or even in widely separated shops.

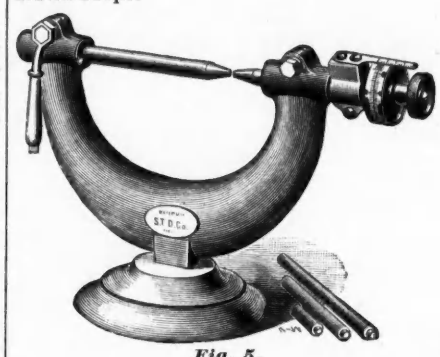

Fig. 5.

In the early days machinists had nothing for this better than steel rules upon which lines are drawn representing inches and divisions of an inch. These scales themselves were and are surprisingly accurate, but the trouble was in getting accurate sizes from them.

If, for instance, a pulley or a gear wheel was to be bored out in one part of a shop, say for a two-inch shaft, and the shaft turned to fit it, it would not do to have the pulley bored in one part of the shop by one workman, and the shaft turned in another part of the shop by another workman, each setting his calipers to a scale or steel rule, for it would be morally certain that, when the two were brought together, they would not fit, and yet each workman could and probably in such a case would declare that he had bored that pulley, or that he had turned that shaft exactly 2". And no one could dispute either of them; for, though it would of course be true that both could not be right, who should decide which was wrong?

(To be Continued.)

MANUFACTURES.

The Lima (Ohio) Regulator Company is enlarging its plant.

The People's Gas Company is erecting a machine shop at Murraysville, Pa.

Work has commenced on the new dry dock engine works, at Detroit, Mich.

A foundry plant is to be established near Stewartstown, in Mifflin County, Pa.

There is a possibility of Kenosha, Wis., securing the location of an eastern iron plant.

The Wright Machine Company, of Worcester, Mass., will erect a building at that city.

The Bonsack (Va.) Woolen-mills are to add, in the spring, one or two sets of new machinery.

The Reliance Wire Works Company, Milwaukee, Wis., will start the erection of its new plant.

Kenyon Brothers are rebuilding their foundry plant at Raritan, N. Y., on a much increased scale.

A foundry department is being added to the Lewis Foundry and Machine Company, of Chicago, Ill.

It is reported that C. E. Baker, of Rock Run, Ala., will establish a machine shop at Acworth, Ga.

The King Mountain (N. C.) Cotton-mill is to add twenty-five hundred spindles to its cotton-mill.

Ground has been broken at Milwaukee, Wis., for the new works of the Bucyrus Steam Shovel Company.

The West End Railway Company contemplates the erection of an electric power plant at Charleston, S. C.

The Nowlin Safety Switch and Signal Company, of Chicago, has been organized, with $500,000 capital stock.

At New Brunswick, N. J., the Gyre Centrifugal Machine Co. has been incorporated, with a capital of $25,000.

The Buffalo and Oakfield Fertilizer Company will begin the erection of a plant at Oakfield, N. Y., at once.

The Snyder-Romans Co., of Helena, Ark., has erected a machine shop, and will erect a new planing mill.

It is stated that the White Sewing Machine Co., Cleveland, O., will build a factory 82x100 feet, to cost $17,000.

About $14,000 worth of new machinery is to be placed in the Sun Foundry and Machine Shops at Provo, Utah.

Spradly, Scott & Prickett are reported to be erecting iron works and a wood-working factory at Asheville, Ala.

The Walter A. Wood Mowing and Reaping Co. has decided upon a location for a western factory in St. Paul, Minn.

Andrew Carnegie has purchased 54 acres of land at Duquesne, Pa., upon which an armor-plate-mill will be erected at once.

D. E. Rhyne & Co., Lincolnton, N. C., are building an addition to their cotton mill, and will put in more machinery.

It is reported that the Little Rock (Ark.) Manufacturing and Tool Company will rebuild its plant, recently burned.

The Napier (Tenn.) Iron Furnace Company has amended its charter, increasing its capital stock from $225,000 to $300,000.

The buildings for the Duvall Engine Works, at Roanoke, Va., have been completed, and are now ready for the machinery.

The Neracher & Hill Sprinkler Company, with a capital of $250,000, will commence business at Warren, O., on January 1.

The Atlantic Traction Co., Atlanta, Ga., is reported as to put additional machinery in the Glenn street electric power plant.

The Atlanta & Chattahoochee River Electric Railway Co., of Atlanta, will, it is stated, erect an electric power plant near Bolton, Ga.

An 80,000 spindle-mill is to be erected at Woonsocket, R. I. The mill is to be built by a company with a capital of $1,000,000.

The Egyptian Knitting-mills, Centralia, Ill., will be increased in capacity; $10,000 new stock has been issued for the purpose.

A $4,000 stock company has been organized at Zelienople, Pa., for the purpose of engaging in the foundry and machine business.

Work will soon commence on the erection of the United States Iron and Tin-plate Manufacturing Co 's new plant at McKeesport, Pa.

Some very extensive improvements, including changes and additions, are to be made at the steel plant at Steelton, Pa., in the early spring.

Mr. Fred H. Arnold has organized a company in New Haven, Conn., to manufacture "invisible pin" casket handles, with a capital of $30,000.

The Phelps Manufacturing Company has been incorporated at San Francisco, Cal., with a capital of $300,000, to manufacture iron, steel, etc.

A factory for the manufacture of new and patented iron novelties will be built by the P. B. Hand Manufacturing Company, Long Beach, Miss.

Contract for the foundations of the buildings of the South Boston Iron Works, at Middlesborough, Ky., has been let, it is stated, to Frederick Wagner.

An effort is being made to arrange the affairs of the Chattanooga (Tenn.) Agricultural Works so that the plant can be put in operation at an early day.

The Northwest Wire Company is being organized at Winnipeg, Man., with a capital stock of $50,000, to manufacture wire fencing, barb wire, wire nails, etc.

Park Bros. & Co., Limited, of Pittsburgh, Pa., are to increase the capacity of their Black Diamond Steel Works by the erection of two new mills.

The Warwick Machine Co., Augusta, Ga., will enlarge its facilities and make arrangements for manufacturing saw-mill plants on an extensive scale.

It is reported that the Eureka Hosiery Co., of Auburn, Me., is to be reorganized and its plant enlarged. A hundred new knitting machines are to be put in.

C. W. Bogart, William Summer and W. A. Agard have incorporated the Bogart Gas Co., for the manufacture of gas engines, at Covington, Ky. The capital stock is $25,000.

An iron foundry and machine shop is proposed at Dunn, S. C. A stock company is being organized for that purpose. Inquiries should be addressed to Joseph Pearsall, secretary.

The Drummondville Foundry, Drummondville, Que., is being incorporated, with a capital stock of $24,000, for the purpose of manufacturing iron castings, mill-work machinery, etc.

Plans have been prepared for a factory addition for the Bridgeport Machine Tool Co., at Bridgeport, Conn. The building will be 73x82 feet, 2 stories, built of brick, and cost $10,000.

The Milwaukee Wheel and Foundry Company has closed its works at Milwaukee, Wis., preparatory to the removal to St. Paul, Minn., where its new works will be in operation in about three months.

Wm. Thomas, J. F. Green, J. T. Hoge and others have incorporated, at Baltimore, Md., the Thomas Novelty Company, to carry on a manufacturing, mechanical and industrial business. The capital stock is $25,000.

The Fisher Smokeless Furnace Company, of Chicago, has been incorporated, with a capital stock of $250,000, for the manufacture of smoke devices. The incorporators are William F. Fisher, C. H. Sieg and W. G. Williams.

Robert A. Chafee, mayor of the city of Aiken S. C., writes us that that city is about to establish water-works, and would be pleased to correspond with the makers of pumps, or with contractors establishing water-works.

Work is progressing rapidly on the Boston Iron and Steel Company's new finishing mill near McKeesport, Pa. The equipment of the mill will include two engines, two heating furnaces, and an 8 and 13-inch boring-mill.

The capacity of the Pittsburgh (Pa.) Diamond Steel Works is to be increased by the erection of two new mills. A 16" billet-mill, in connection with a 10" tire or hoop-mill will be put in, and will be operated by a 36"x48" engine.

There is water-works agitation in Ludlow, Ky.; Hartford, Conn.; Guelph, Ont.; Victoria, Tex.; Sherman, Tex.; Anthony, Fla; Madisonville, O; Vancouver, B C; Minneapolis, Minn; Spokane Wash.; Springfield, Ill.; Elgin, Ill.

The contract for the iron work for the elevated railroad to be erected in Philadelphia has been divided between the Phœnix Iron Company, of Phœnixville, Pa., and Cooper, Hewitt & Co., of the Trenton Iron Works, Trenton, N. J.

A syndicate is talking of leasing the old Camden & Amboy R. R. shops, Bordentown, W T., recently fitted up by the King Locomotive Works, for the purpose of starting iron works of some description, in which some 300 skilled mechanics are to be employed.

Machinists' Supplies and Iron.

NEW YORK, January 2, 1892

Iron—American Pig—No change of importance has taken place in the condition of the market since our last report.

We quote Standard Northern brands, No. 1 Foundry, at $16 to $17; No. 2 is selling at $15 to $16 50, and Grey Forge at $13.75 to $14 50. Southern brands of good quality are obtainable at $16 to $17.50 for No. 1 Foundry; $15.50 to $16 for No. 2; and $14.25 to $14 50 for No. 3.

Scotch Pig—We quote Coltness at $22, and Eglington at $20 25

Copper—The copper market is firm. Lake Copper is quoted at 10¾c. to 11c., and Casting Copper at 10¼c. to 10⅜c.

Lead—The market is more or less nominal at 4 25c. to 4 30c. There is no evidence of business. In offerings of January delivery at 4.30c. to 4 32½c. no interest is taken.

Lard Oil.—The market is steady at 54c. to 55c. for Prime City, according to holder and quantity. Western on spot is quoted at 53c to 54c.

Spelter—The market is nominal at 4.75c. for New York delivery. Stock is accumulating in the West, and some effort may be made to unload early this month.

Tin—The market is steady and dull, both here and abroad. The spot price is still 19 95c. asked for 10 ton lot.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

A mechanical draftsman desires position. Address BOX 23, AMERICAN MACHINIST.

Wanted—A skilled machinist to work for board and tuition in a university; state past experience and wages. Address BOX 30, AMERICAN MACHINIST.

A mechanical engineer with 12 years practical experience, who has successfully filled important positions in mfg. concerns, is open for engagement; well posted in modern machine shop methods, in automatic machinery and tools for the production of duplicate and interchangeable parts, and in operating them to their highest economy. A good executive, with perfect command over help, and a successful machine designer. A1 references. Address New Englander, care AMERICAN MACHINIST.

An educated and thoroughly practical mechanical engineer, who can furnish the highest references, wishes to connect himself with a mfg. concern; experienced in handling help and well up to the times; have had charge for a number of years of a large wire manufactory, and thoroughly posted in the most modern and economical methods of handling this work; well up in test scale work, and in the physical determination of the quality, etc., of wire rods; experienced also in general machine shop work, a good machine designer, and have had a general mechanical engineering experience. Address Progressive, care AMERICAN MACHINIST.

Advertiser solicits correspondence of manufacturers or others needing the services of a mechanical engineer who has filled positions of trust and charge, experienced in the systematic production of work, keeping account of costs, estimating, and in meeting competition; a good and original machine designer, well up in labor-saving devices, and a competent factory manager; have had a considerable experience in the erection and testing of steam plants and am familiar with most of the appliances used in this line; have had charge of the designing and construction of factory buildings (including their equipment), and competent to take charge of such work from the ground up. Can furnish excellent reference. Address M. A. S. M. E., care AMERICAN MACHINIST.

Electrical draftsman (Swede) open for engage't; 2 years' machinist, 5 years' draftsman. "Electric," AMERICAN MACHINIST.

A thoroughly practical mechanical draftsman & designer desires position. Box 27, AM MACHINIST.

Wanted—Position as assistant draftsman; 5 years' experience. BOX 28, AM. MACHINIST.

Constructing eng'r desires steam plant work or supt's position; salary, $200 monthly. M. E., AM. MACHINIST.

Wanted—Pattern maker; state experience fully, and wages wanted; steady job; nice shop. Address Connecticut, care AMERICAN MACHINIST.

A young Norwegian (21) wants position as draftsman, college graduate, 2½ years' practice in shop and drawing room. Address Box 24, AM. MACHINIST

Mechanical engineer, best references, college grad., shop practice accustomed to calculations, desires sit in N. Y. City or B'klyn. Box 25, AM. MACH.

Wanted—Pattern maker used to general work, and can do drafting, and is not afraid of work. Box 26, AM. MACHINIST.

Wanted—Position as sup't., foreman or chief draftsman; exp'd in designing and manufacturing Web, cylinder and litho. printing presses, & bookbinding mach'y; highest refs. Box 22, AM. MACH.

Wanted—Melter for an iron foundry; none but a first-class man who thoroughly understands the business. Apply to The Davenport & Treacy Co., cor. Ave. D and Eleventh St., New York.

A young tool maker, temperate and well educated, desires to learn drafting where common sense and honest attention will be appreciated; wages no object. R. H., care AM. MACHINIST.

Wanted—A position as foundry foreman; having 20 years' experience on all kinds of light and heavy work, can furnish first-class recommend. Address Box 29, AM. MACHINIST

Wanted—Young man to take charge of about 20 lathe hands, who has had experience as gang boss on piece-work system; also one to take charge of about 20 men on vise work. Address Manufacturer, care AMERICAN MACHINIST.

Wanted—Position as sup't, assist't sup't or designer in a m'f'g concern by a thorough draftsman and mechanical engineer, with 15 years' exp. as machinist, draftsman, & superintend'g eng; 1st-class ref. Address Theory & Practice, AM. MACHINIST.

Wanted—Position as supt. or ch'f eng. with steam eng. builders, or concern wishing to engage in eng. building; 10 y'rs exp on automatic high-speed engs.; can introduce new shaft governor, balanced valve, and other features. G. W., AM MACHINIST.

Young man, thorough mechanic, of wide experience, and conversant with the best machine shop practice, would like position as assistant foreman; or would take charge of small shop; able to invent new tools and methods; South or West preferred. Address Box 21, care AM. MACHINIST.

Wanted—First-class machinist and tool maker, progressive and practical; accustomed to quick, accurate work; good chance for right man; shop new, thoroughly equipped, clean and orderly; living cheap; state exp. and wages. B. & B., No. 214 First Ave., S. Minneapolis, Minn.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Special leather and cement for covering pulleys; no rivets required; local agents wanted. Crescent Mfg. Company, Cleveland, Ohio.

To manufacture light special and automatic machinery, novelties, models, patterns, tools, etc., by Orange Machine and Repair Works, Orange, N. J.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

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Engines and Rolling Mill Machinery, all as good as new, having been used less than one month.
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1 Upright Engine, 24 x 30 inches, with 25-ton fly wheel.
1 Upright Engine, 18 x 20 inches, with 10-ton fly wheel.
3 Upright Engines, 7½ x 12 inches.
2 Upright Engines, 6 x 10 inches.
1 Horizontal Engine 9 x 16 inches.
2 Two-flue Boilers 48 inches x 26 feet.
1 Doctor Pump, 5-inch plungers.
1 Large Alligator Shears, 14-in blade, with 10 x 12 in. Engine.
5 Pairs Alligator Shears, 12-inch blade, to be run by belt and gearing.
1 Thirty-ton Scales, never taken out of original package.
3 2500-pound Scales, never taken out of original package.
14 Housings for three high 20 inch train rolls with
11 Rolls boxing, bed plates, etc., for same, for merchant bar iron.
2 Housings, two high 12 inch, and two rolls for same.
1 Squeezer, coffee-mill pattern.
2 Hot-saws with 42-inch saws, stands, mandrels and pulleys
3 Valves, 14-inch, 12 inch and 10-inch.
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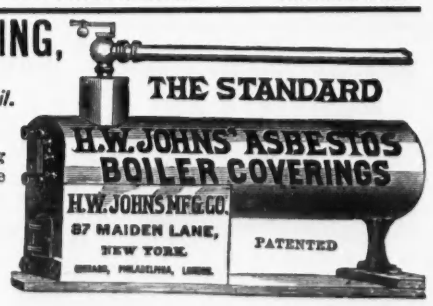

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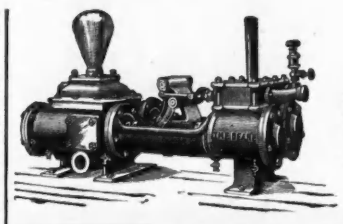

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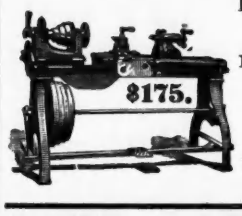

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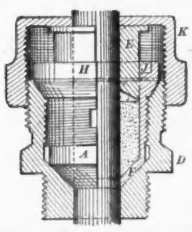

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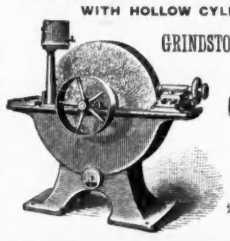

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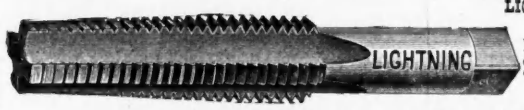

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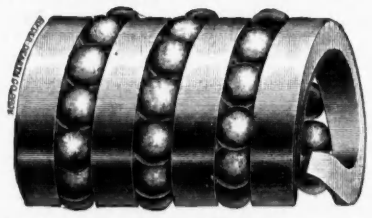
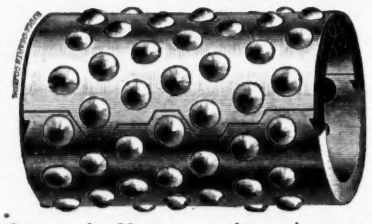
No. 1   No. 2

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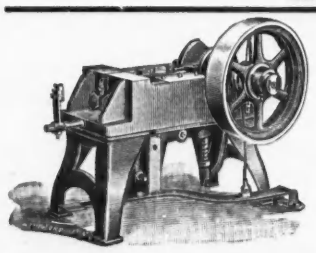

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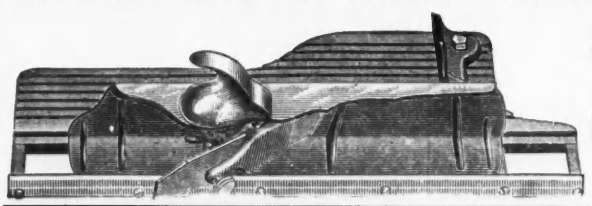

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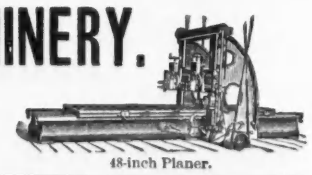
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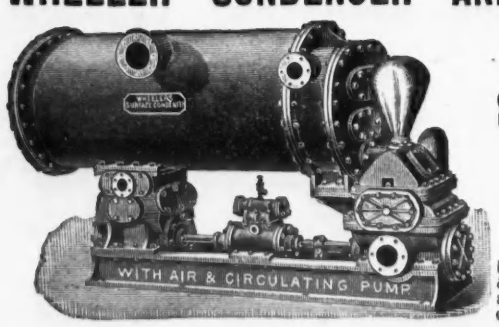

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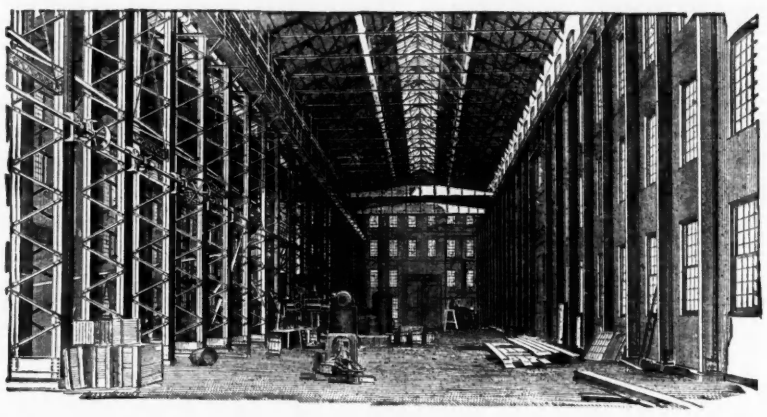

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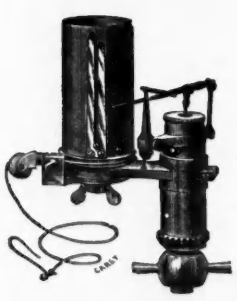

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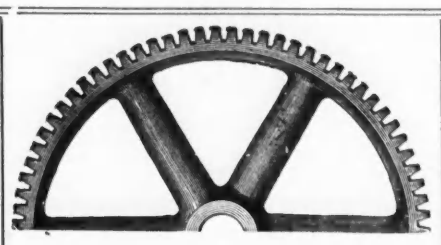

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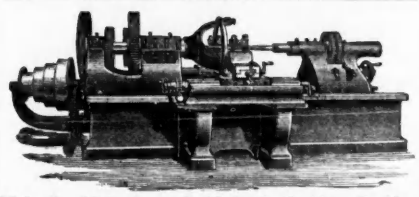

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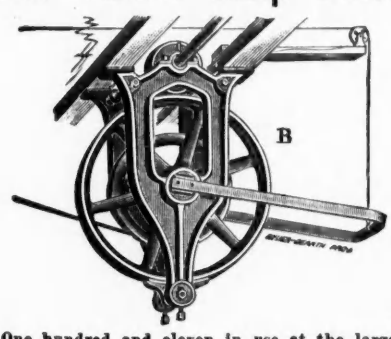

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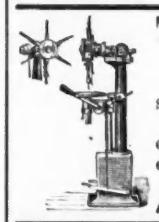

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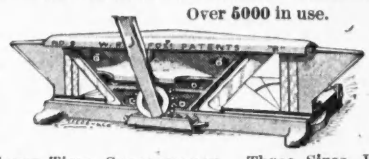

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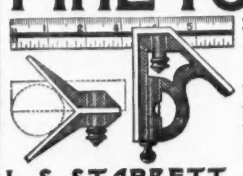

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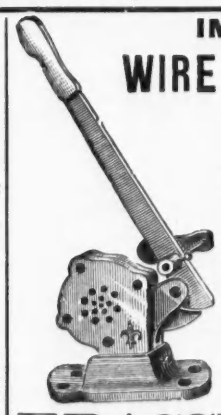

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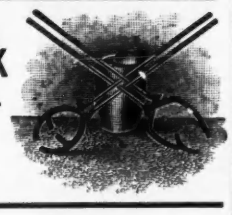

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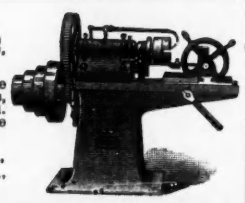

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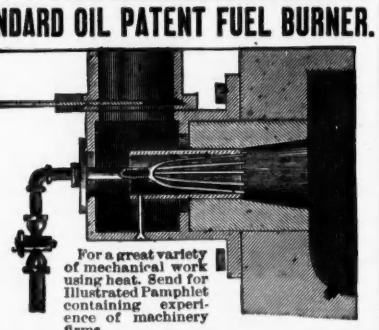

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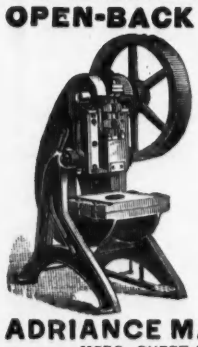

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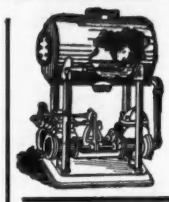

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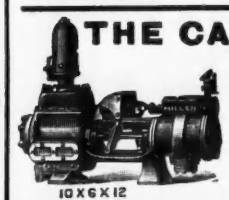

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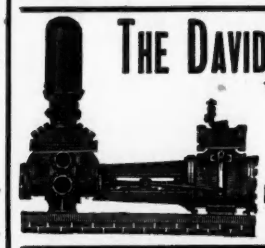

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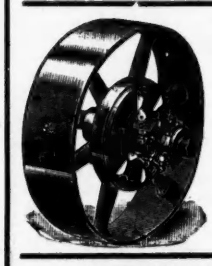

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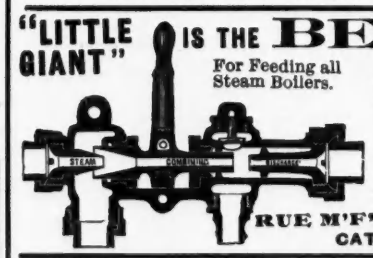

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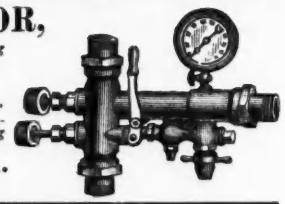

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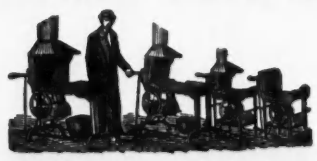

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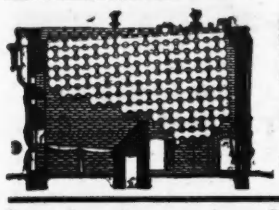

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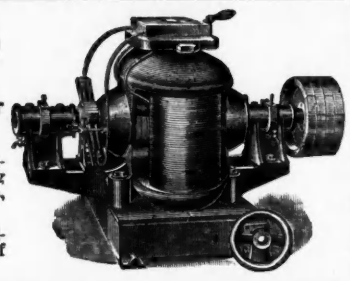

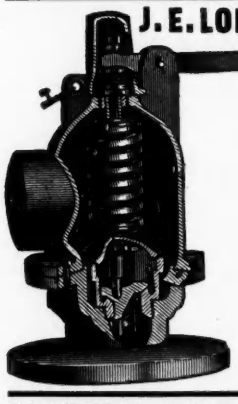

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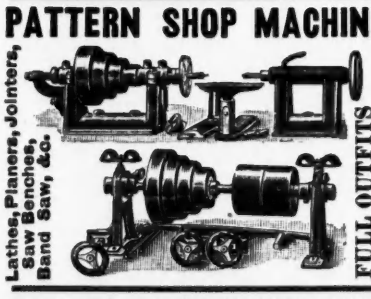

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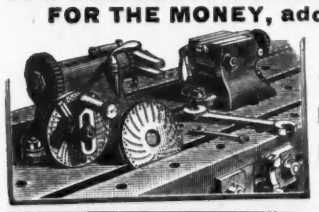

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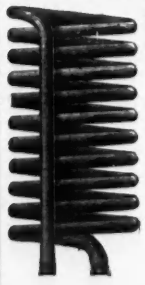

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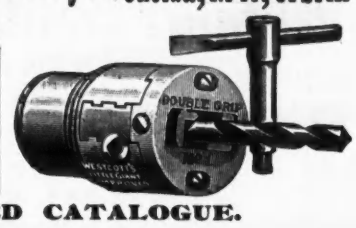

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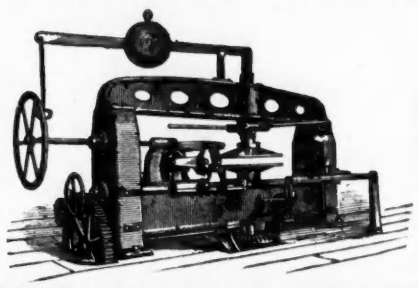

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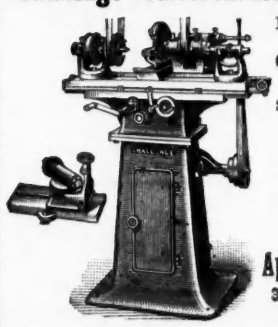

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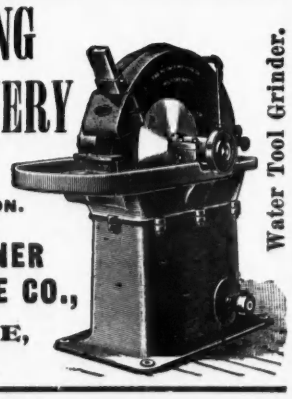

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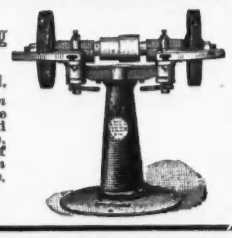

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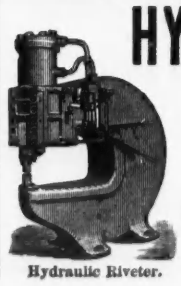

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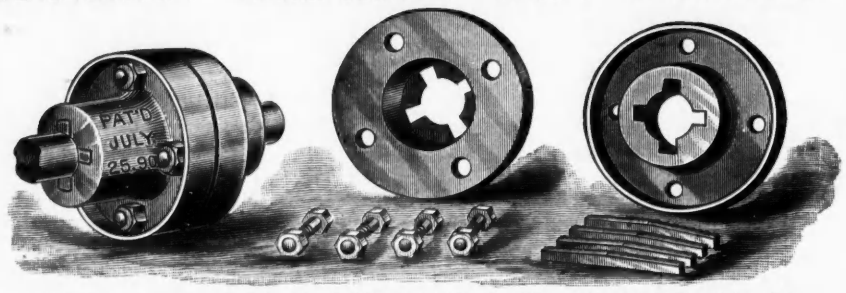

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GENTLEMEN:—The Grinding Machine purchased of you is giving entire satisfaction. We regard it as a superior tool in both design and execution.
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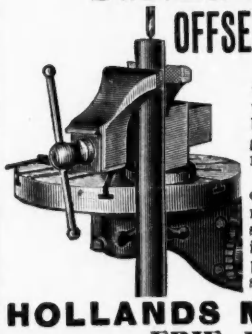

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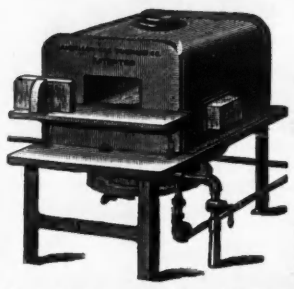

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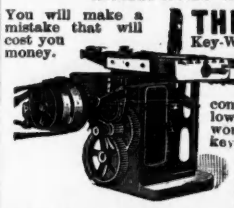

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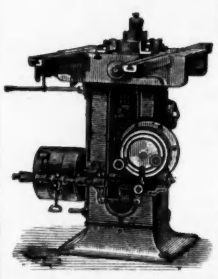

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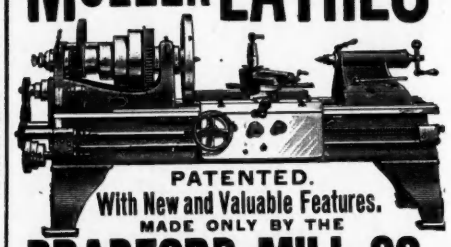

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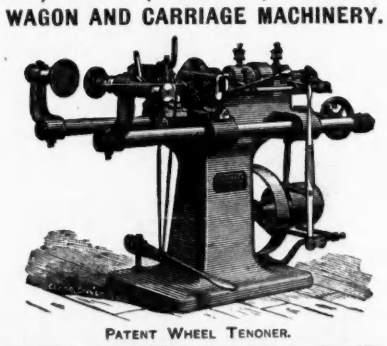

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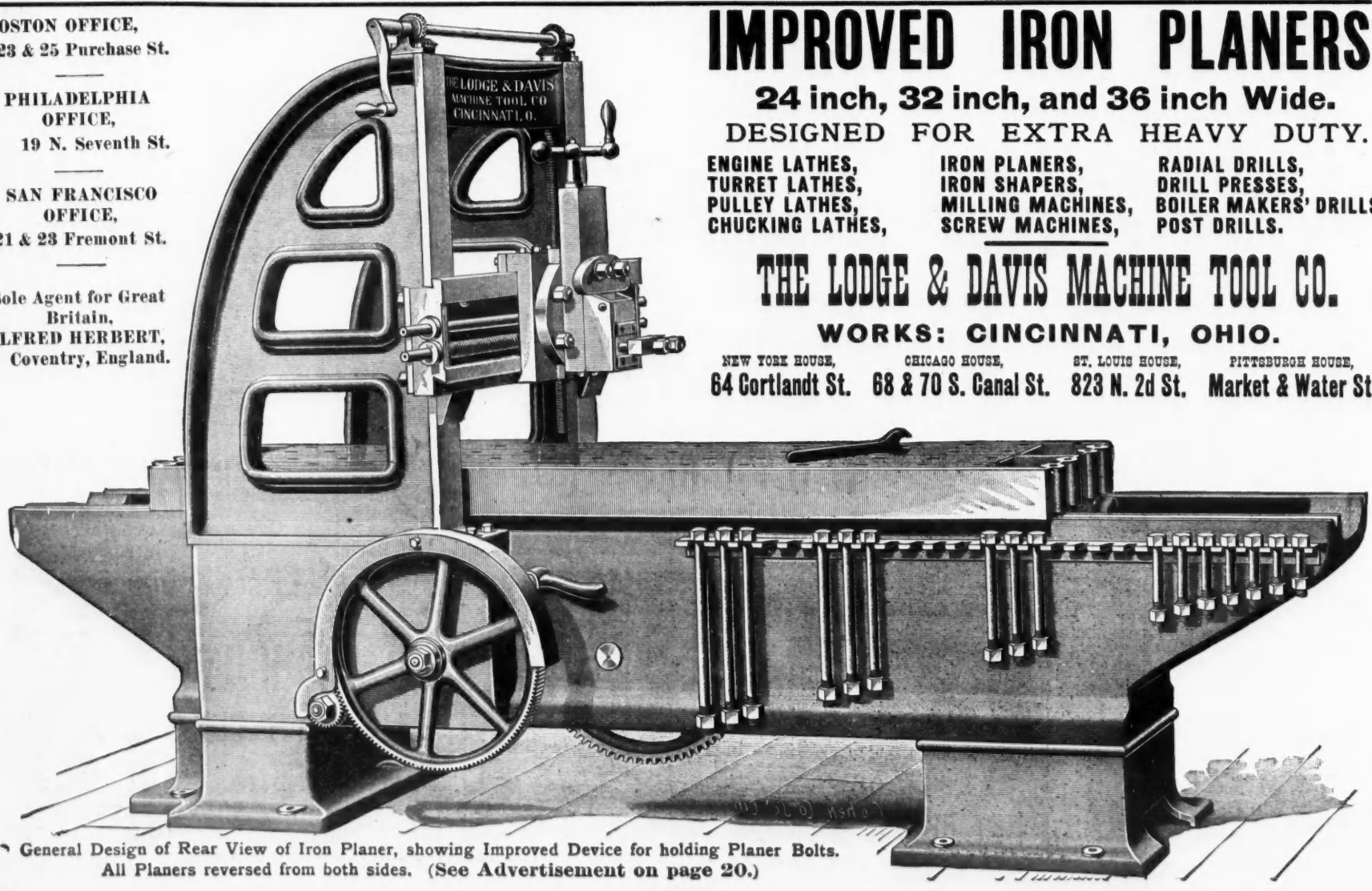

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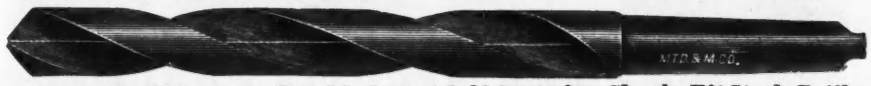

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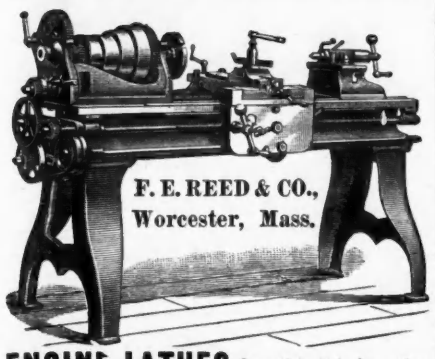

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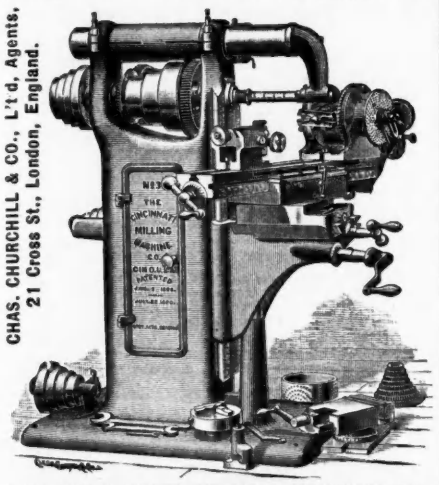

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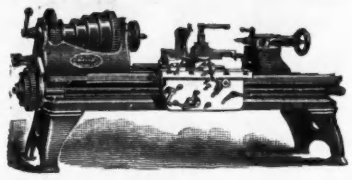

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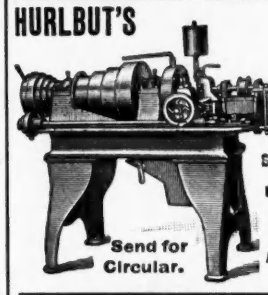

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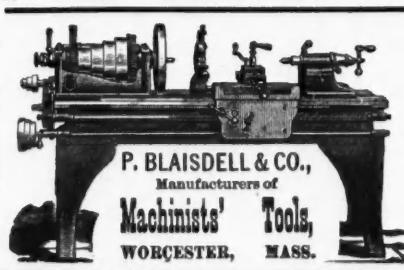

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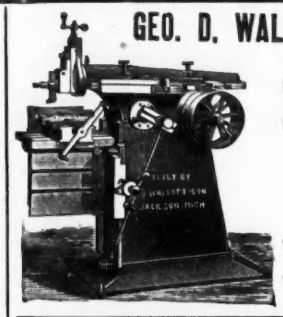

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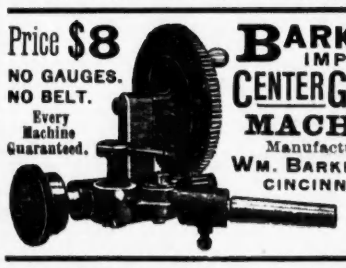

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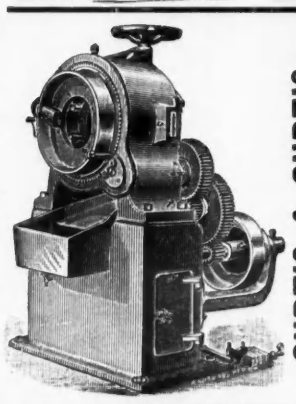

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JOB WORK DESIRED.

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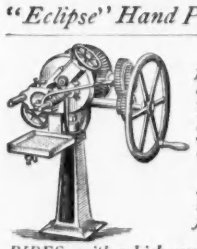

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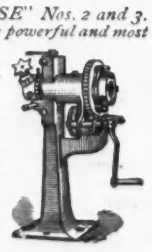

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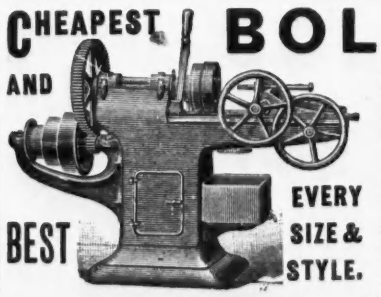

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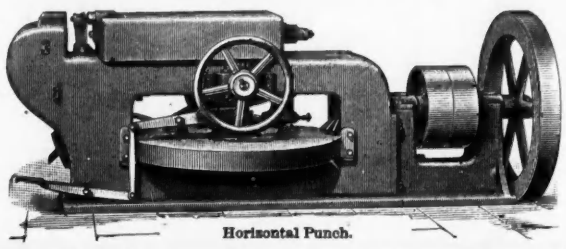
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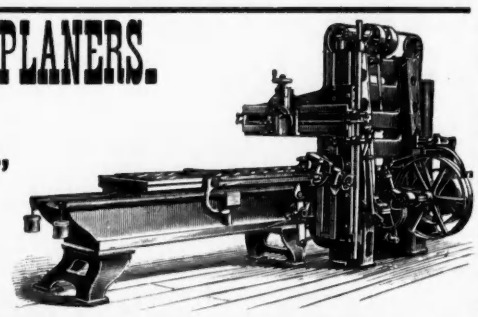

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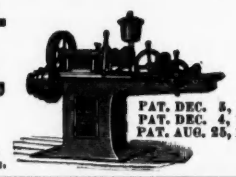
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.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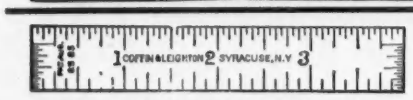

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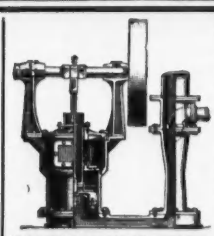
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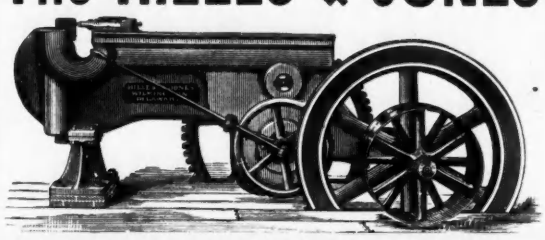

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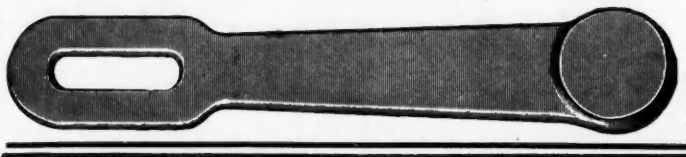

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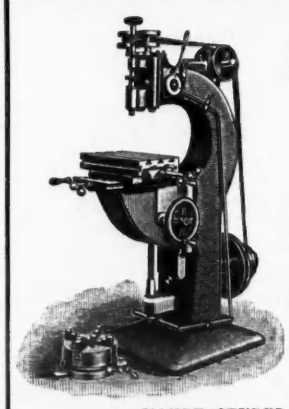

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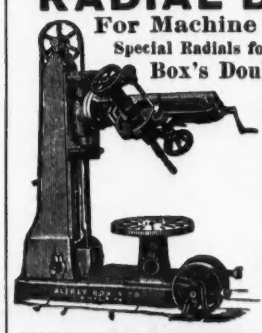

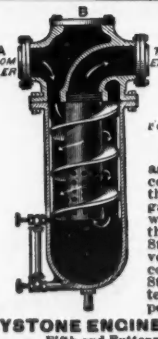

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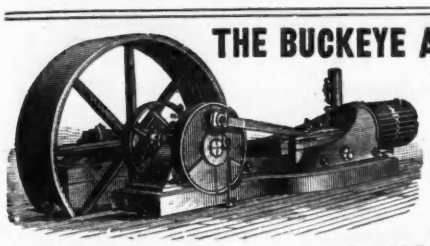

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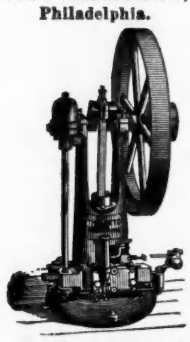

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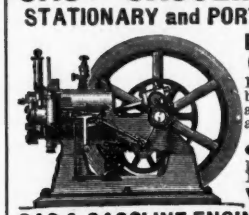

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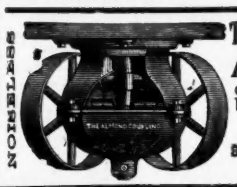

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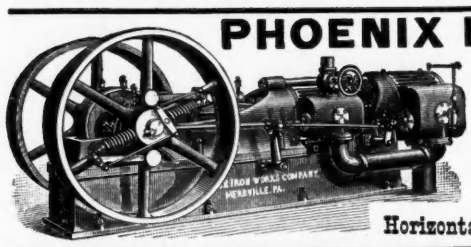

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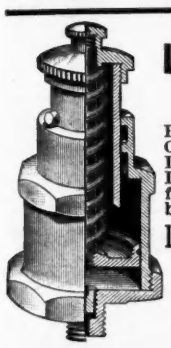

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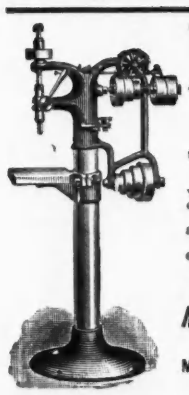

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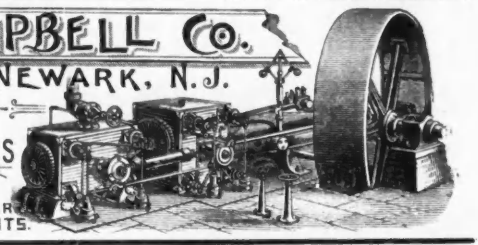

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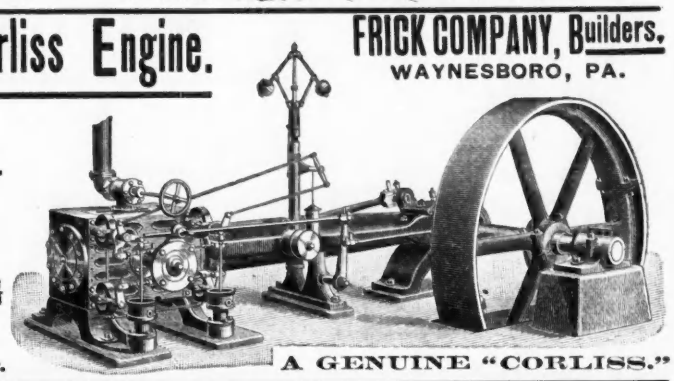

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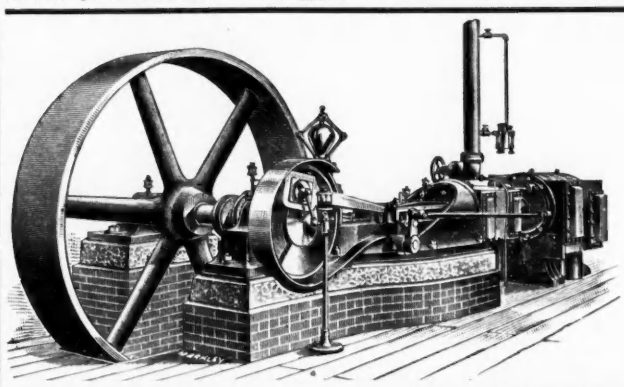

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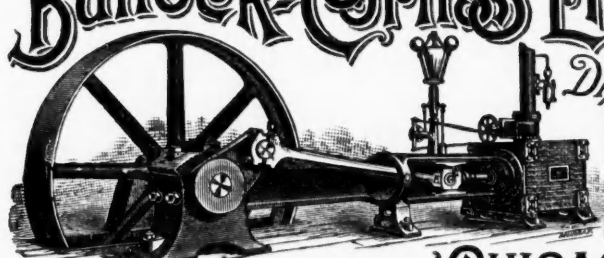

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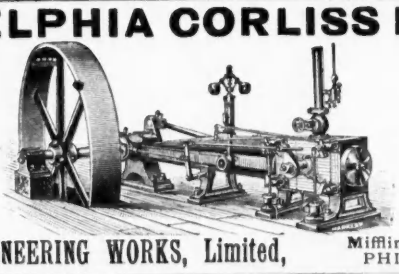

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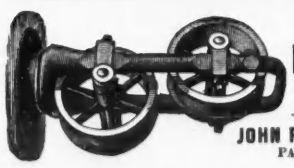

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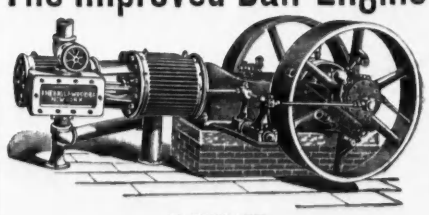

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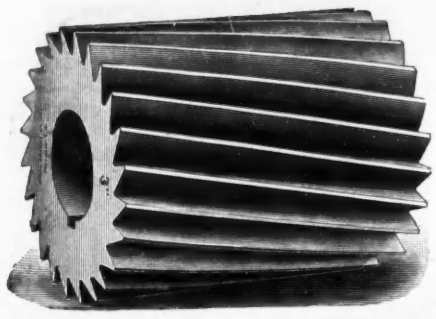

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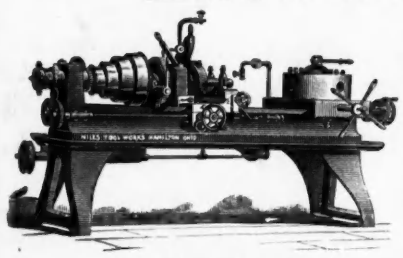

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You MAY save a few cents by putting in one cheap link, You MAY save a few cents by putting on one cheap VALVE—BUT, DO YOU? You may also repair this break with ANOTHER cheap link or valve, but can you AFFORD to, even if the valve COSTS YOU NOTHING? Decidedly You CANNOT. Why not get at once a GENUINE JENKINS BROS. VALVE, STAMPED WITH TRADE MARK? You accomplish nothing by getting an IMITATION Jenkins Bros. Valve—there are over fifty on the market—in fact, you have only SPENT A LITTLE MORE MONEY and still your chain BREAKS AT THE SAME LINK. ***JENKINS BROS., New York, Philadelphia, Boston & Chicago.***

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For the twofold purpose of obtaining valuable statistics, and to encourage the men now operating the tools, we offer the following rewards: **$50.00 to the first; $25.00 to the second; $15.00 to the third, and six additional prizes of $10.00 each, to the men who, before July 1st, 1892, turn out the largest day's work on one of these Standard Lathes.** All character of work will be considered, and the names of the successful competitors will be published in the American Machinist. No proprietor or foreman of a shop will be eligible to a prize, but the amount of work must be endorsed by a proprietor.

Communications may be addressed to the Works or any of our Stores.
☞ Printed Copies of this reward furnished for posting in shops.

THE LODGE & DAVIS MACHINE TOOL CO.
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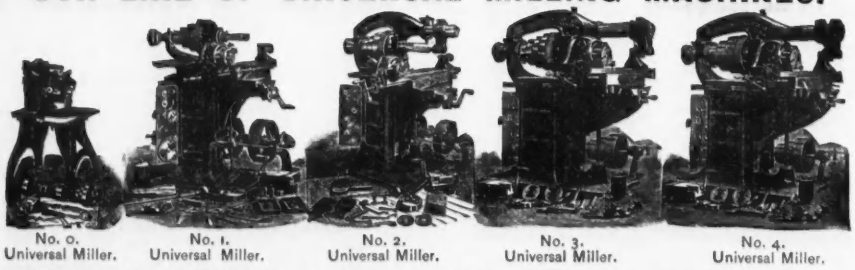
OUR LINE OF UNIVERSAL MILLING MACHINES.



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Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines,
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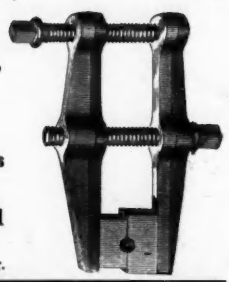

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Drop Forgings of Bronze, Copper, Iron and Steel OF ALL DESCRIPTIONS.

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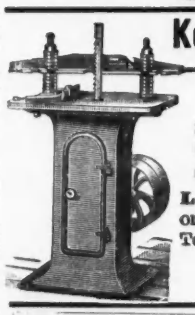

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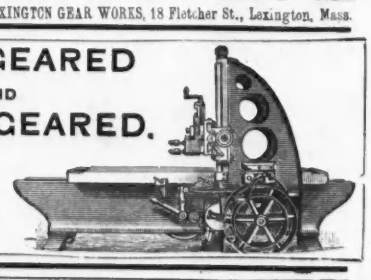

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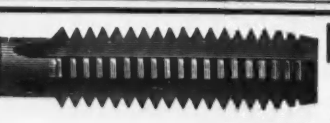

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